ROHDE&SCHWARZ

DOCUMENTATION

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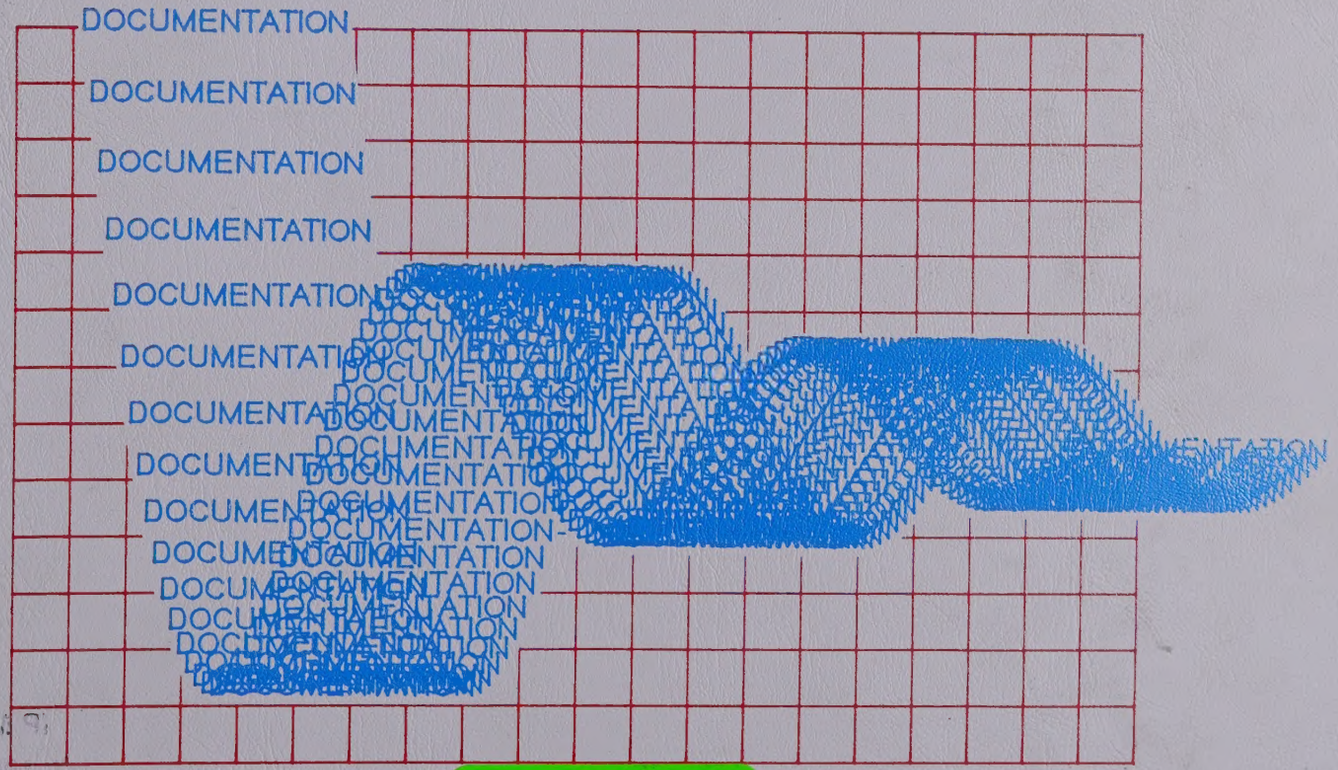

MP MASTER

MA20539

ROHDE&SCHWARZ
Instruments
Division

Operating Manual

DIGITAL RADIOCOMMUNICATION TESTER

CMD 52/55

1050.9008.52/.55

Printed in the Federal
Republic of Germany

Certificate of quality
EC Certificate of Conformity
Safety Instructions
List of R & S Representatives

Data Sheet

1 Preparation for Use ..... Register 1

2 Manual Operation ..... Register 2
Getting Started
Description of the Menus (Reference Description)

3 Remote Control ..... Register 3
Common Commands
Device-specific Commands (Annex)

REG. NR. 1954-02

Qualitätszertifikat

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätssicherungssystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätssicherungssystem ist nach ISO 9001 zertifiziert.

Sollten Sie trotzdem bei der Erst-Inbetriebnahme Anlaß zu einer Beanstandung haben, senden Sie bitte das rückseitige Fax-Formular ausgefüllt zurück. Beauftragen Sie bei Bedarf die nächstliegende Rohde&Schwarz-Servicestelle mit der Reparatur.

Certificate of quality

Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality assurance standards. The Rohde&Schwarz quality assurance system is certified according to ISO 9001.

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Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes d'assurance-qualité. Le système d'assurance-qualité de Rohde&Schwarz a été homologué conformément à la norme ISO 9001.

Si, malgré cela, vous avez des réclamations lors de sa première mise en marche, nous vous prions de bien vouloir remplir le formulaire de télécopie au verso et de nous le retourner. Le cas échéant, contacter le point de service après-vente Rohde&Schwarz le plus proche pour qu'il effectue la réparation.

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Empfänger
Addressee
Destinataire

ROHDE & SCHWARZ GmbH & Co. KG
Zentrales Qualitätswesen
Mühldorfstraße 15

D - 81671 München

Telefax-Nr. des Empfängers
Telefax number of addressee
N° de téléfax du destinataire

(*49) 89 4129 3325

Betreff
Subject
Sujet

Anlieferfehler
Dead on Arrival
Défaut constaté a l'arrivée

Absender
Sender
Expéditeur

Telefon
Telephone
Téléphone

Telefax
Téléfax

Anzahl der Seiten inkl. dieser Seite
Number of pages incl. this page
Nombre de pages incluant cette page

Beanstandung / Shortcomings / Défauts

Gerätetype:
Type:
Type d'appareil:

Sach-Nr.:
Stock No.:
N° de référence:

Serien-Nr.:
Serial No.:
N° de série:

R&S-Auftrags-Nr.:
R&S Order No.:
N° de commande R&S:

Kurze Beschreibung der Beanstandung / Short description of shortcoming / Description de défaut:

Datum / Date / Date

Unterschrift / Signature / Signature

ROHDE&SCHWARZ

EC Certificate of Conformity

(to EMC Directive 89/336/EEC)

CE

This is to certify that

Digital Radiocommunication Tester
CMD 52/55
1050.9008.52/.55

(equipment, type, designation)

complies with the provisions of the Directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 89/336/EEC).

This declaration of conformity of the European Communities is the result of an examination carried out by the Quality Assurance Department of **ROHDE & SCHWARZ** in accordance with European Standards EN 50081-1 and EN 50082-1, as laid down in Article 10 of the Directive.

ROHDE & SCHWARZ
GmbH & Co. KG

Safety Instructions

This unit has been designed and tested according to the standards outlined overleaf and has left the manufacturer's premises in a state fully complying with the safety standards.

In order to maintain this state and to ensure safe operation, observe the following instructions, symbols and precautions.

1) When the unit is to be permanently cabled, first connect protective ground conductor before making any other connections.

2) Built-in units should only be operated when properly fitted into the system.

3) For permanently cabled units without built-in fuses, automatic switches or similar protective facilities, the AC supply line shall be fitted with fuses rated to the units.

4) Before switching on the unit ensure that the operating voltage set at the unit matches the line voltage.

   If a different operating voltage is to be set, use a fuse with appropriate rating.

5) Units of protection class I with disconnectible AC supply cable and plug may only be operated from a power socket with protective ground contact.

   The protective ground connection should not be made ineffective by an extension cable.

   Any breaking of the protective ground conductor within or outside of the unit or loosening of the protective ground connection may cause the unit to become electrically hazardous.

   The protective ground conductor shall not be interrupted intentionally.

6) Before opening the unit, isolate it from the AC supply.

   Adjustment and replacement of parts as well as maintenance and repair should be carried out only by specialists approved by R & S.

   Observe safety regulations and rules for the prevention of accidents.

   Use only original parts for replacing parts relevant to safety (e.g. power on/off switches, power transformers or fuses).

7) Also observe the additional safety instructions specified in this manual.

Explanation of Symbols Used

- Read operating manual, observe the safety symbols used

- Caution, shock hazard

- Protective ground connection

- Unit ground

- Equipotentiality

- Ground

This is to certify that the unit below

Digital Radiocommunication Tester CMD 52/55

complies with the following standard:

DIN 57411 Part 1/VDE 0411 Part 1

"Safety Requirements for Electronic Measuring Apparatus"
(almost fully adapted to IEC 348)

095.1000 Bl. 16

ROHDE&SCHWARZ

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Page

1 Preparation for Use 1.1

1.1 Explanation of Front-panel and Rear-panel Views 1.1

Front view 1.2
Front view (operating fields) 1.3
Rear view 1.4

1.2 Putting into Operation 1.5

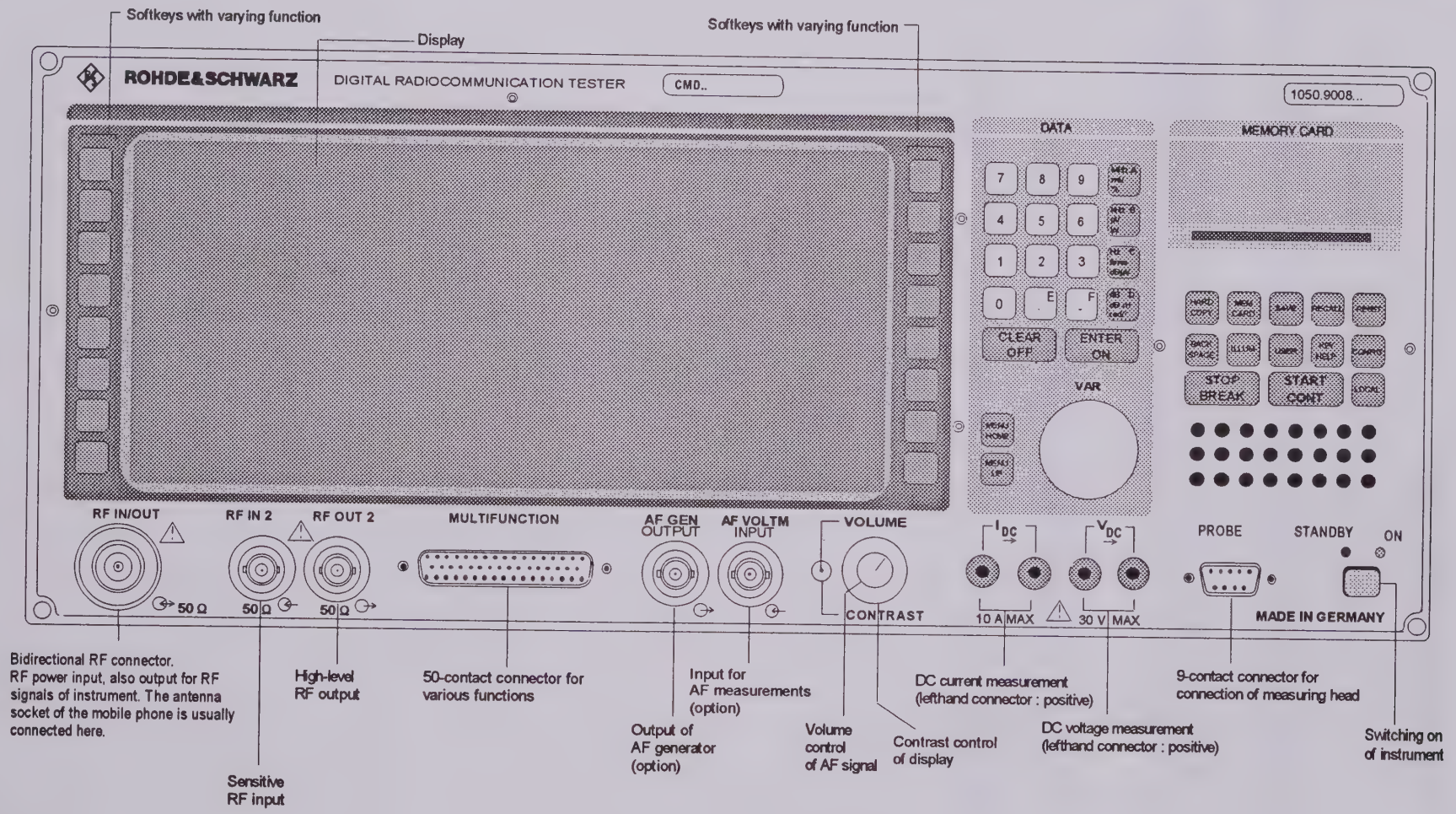
1.2.1 Setting up the Instrument 1.5
1.2.2 Mounting in a 19" Rack 1.5
1.2.3 Connecting the Instrument to the AC Supply 1.5
1.2.4 How to ensure EMC 1.6
1.2.5 Switching on the Instrument 1.6
1.2.6 Power Fuses 1.6

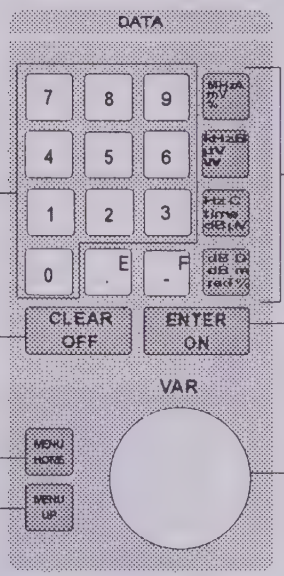
1 Preparation for Use

- Take the instrument out of the shipping box and check whether the items listed are all included.
- Carefully check the instrument for mechanical damage. Should the instrument be damaged, immediately notify the forwarder which shipped the instrument to you. Therefore make sure to keep the box and packing material.
- For further transport or shipment of the instrument, the original packing should also be used. It is urgently recommended to use the protective caps included in the shipping box for protection of the front and rear panel. This serves to prevent damage e.g. to the controls on the front panel.

1.1 Explanation of Front-panel and Rear-panel Views

The next pages show the front and rear views of the instrument, each with brief explanations of the controls and connectors.


Softkeys with varying function
Display
Softkeys with varying function
ROHDE&SCHWARZ
DIGITAL RADIOCOMMUNICATION TESTER
CMD..
1050.9008...
DATA
MEMORY CARD
CLEAR OFF
ENTER ON
VAR
STOP BREAK
START CONT
RF IN/OUT
RF IN 2
RF OUT 2
MULTIFUNCTION
AF GEN OUTPUT
AF VOLTM INPUT
VOLUME
CONTRAST
50 Ω
50 Ω
50 Ω
10 A MAX
30 V MAX
PROBE
STANDBY
ON
MADE IN GERMANY
Bidirectional RF connector. RF power input, also output for RF signals of instrument. The antenna socket of the mobile phone is usually connected here.
Sensitive RF input
High-level RF output
50-contact connector for various functions
Output of AF generator (option)
Input for AF measurements (option)
Volume control of AF signal
Contrast control of display
DC current measurement (lefthand connector : positive)
DC voltage measurement (lefthand connector : positive)
9-contact connector for connection of measuring head
Switching on of instrument



Numeric keypad for all numerical entries.

Aborts entries not yet concluded.
Switches off or selects the minimum value when entering values.
Switches off running measurements.
Switches off various functions (e. g. Range).

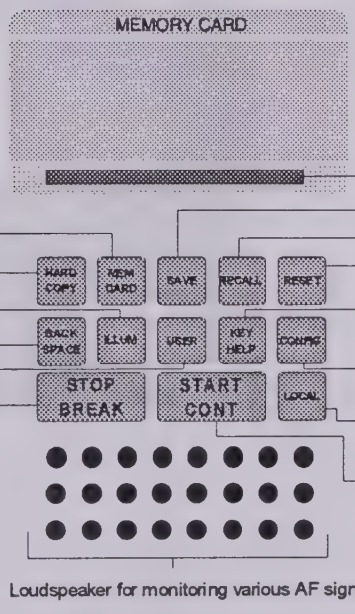
Changes to the highest-level menu.

Changes to the next higher menu.

Dimension keys with ENTER function
Hexadecimal digits A to D

Key terminating all numeric entries not having or not requiring any dimension or quasidimension. Activates the functions which were deactivated by Off (often measurements or levels).

Spinwheel



Slot for insertion of the memory card.

Key for initiating storage operations on the memory card.

Saves instrument states.

Recalls instrument states.

Hardcopy of screen output on printer.

Sets the instrument to a defined status.

Varies the brightness of screen illumination.

As a prefix before activating a softkey, help texts as to the function are called instead of the function itself.

Deletes the figure last entered.

User-specific function (sequence control, IEC bus).

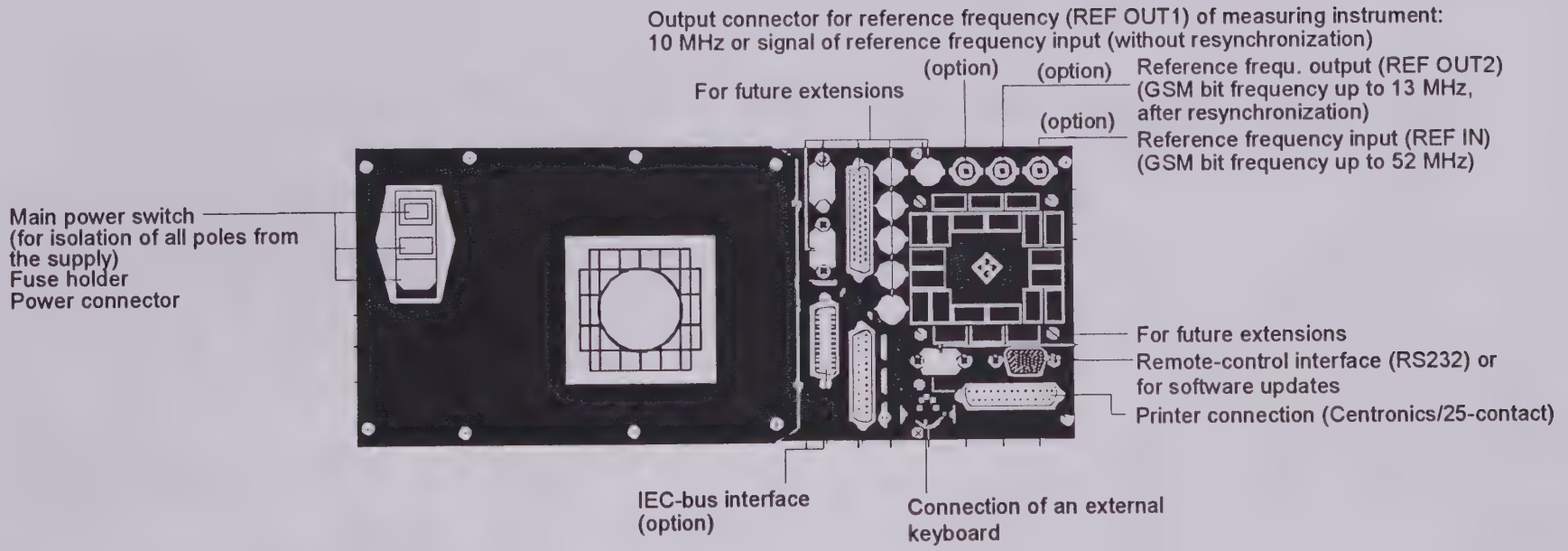
As a prefix before activating a softkey, a change into the configuration menu is performed instead of the function.

Interrupts measurements or measurement sequences and aborts editor entries.

Switches from IEC-bus control to manual operation.

Starts measurements interrupted with STOP BREAK. Execution of sequential programs.

Loudspeaker for monitoring various AF signals.


Output connector for reference frequency (REF OUT1) of measuring instrument:
10 MHz or signal of reference frequency input (without resynchronization)
(option)
(option)
Reference frequ. output (REF OUT2)
(GSM bit frequency up to 13 MHz,
after resynchronization)
For future extensions
(option)
Reference frequency input (REF IN)
(GSM bit frequency up to 52 MHz)
Main power switch
(for isolation of all poles from
the supply)
Fuse holder
Power connector
For future extensions
Remote-control interface (RS232) or
for software updates
Printer connection (Centronics/25-contact)
IEC-bus interface
(option)
Connection of an external
keyboard

1.2 Putting into Operation

1.2.1 Setting up the Instrument

For bench measurements, it is recommended to fold out the feet at the bottom of the instrument.

For convenient operation of the instrument note the following:

- Do not cover the ventilation openings!
- Ambient temperature 0 to 45 °C.
- Avoid moisture condensation. If it however occurs, the instrument must be wiped dry before switching on.
- Note the warm-up time of the temperature-controlled OCXO reference oscillator (option).

1.2.2 Mounting in a 19" Rack

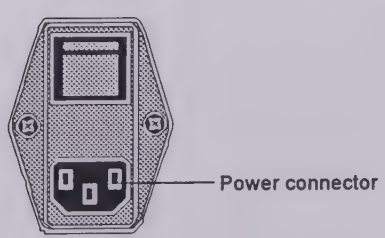
Using the rack adapter ZZA-94 (order number 396.4905.00) the instrument can be mounted in 19" racks according to the mounting instructions supplied.

As the power switch is situated at the rear of the instrument, an all-pole mains disconnection must be near at hand for safety reasons when the instrument is mounted in a rack!

1.2.3 Connecting the Instrument to the AC Supply

The CMD is equipped with an AC voltage detection, i.e. it is automatically set to the respective AC supply voltage. (Range: AC voltage 90 to 132 V and 180 to 265 V; 47 to 440 Hz).

➢ Plug the supplied power cable into the rear power connector and connect the CMD to the current supply.



1.2.4 How to ensure EMC

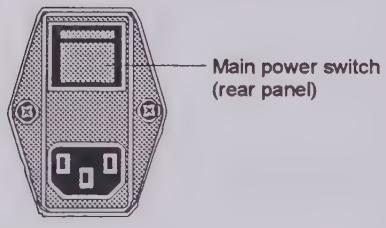
In order to avoid electromagnetic interference, the instrument may only be operated in the closed state and with all shielding covers. Only appropriate shielded signal and control cables may be used.

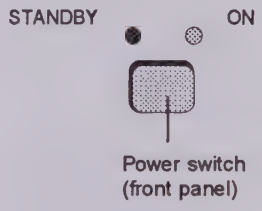
1.2.5 Switching on the Instrument

As soon as the main power switch at the rear of the instrument is in the OFF position, the complete instrument is disconnected from the power supply. If it is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch at the front of the instrument.

Standby position:
Only the reference frequency oscillator is supplied with operating voltage and the yellow LED (STANDBY) is illuminated.

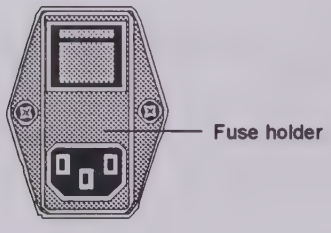
ON position:
The green LED (ON) is illuminated, all modules of the instrument are supplied with operating voltage.





1.2.6 Power Fuses

The CMD is equipped with two fuses complying with the label of the power supply. The fuses are located in the extendable fuse holder. which is inserted between power connector and main power switch.



Page

2 Manual Operation 2.1

2.1 Getting Started 2.1

2.1.1 Manual Tests: Connecting the Mobile to the CMD 2.2

2.1.2 Manual Tests: Setting up a Call to the Mobile Phone 2.4

2.2 Menu Structure 2.8

2.3 Basic Steps of Operation 2.8

2.4 Description of the Menus 2.10

2.4.1 Selection Menu 2.10

2.4.2 Manual Test 2.12

2.4.2.1 MOBILE TEST Menu (Wait Location Update) 2.12
2.4.2.2 MOBILE TEST Menu (After Location Update) 2.13
2.4.2.3 CALL ESTABLISHED Menu 2.14
2.4.2.4 CALL ESTABLISHED/TUNE BS SIGNAL Menu 2.16

2.4.3 GSM Measurements 2.17

2.4.3.1 POWER RAMP Menu (only with Option CMD-B4) 2.17
2.4.3.2 PHASE FREQUENCY Menu (only with Option CMD-B4) 2.19
2.4.3.3 BIT ERROR RATE Menu (only with Option CMD-B4) 2.20
2.4.3.4 BIT ERROR RATE Menu (USER 1...USER 7) 2.21
2.4.3.5 CONTINUOUS BIT ERROR RATE Menu 2.22

2.4.4 Conventional Measurements 2.24

2.4.4.1 ADDITIONAL MEASUREMENTS Menu 2.24

2.4.5 Module Test 2.26

2.4.5.1 BURST ANALYSIS Menu 2.26
2.4.5.2 RF GENERATOR Menu 2.28

2.4.6 Configuration Menus 2.29

2.4.6.1 Configuration Selection Menu 2.29
2.4.6.2 Configuration Menus for ADDITIONAL MEASUREMENTS 2.30
2.4.6.2.1 Configuration Menu AF METER 2.30
2.4.6.2.2 Configuration Menu DISTORTION METER 2.31
2.4.6.2.3 Configuration Menu AF GENERATOR 2.31
2.4.6.3 Configuration Menu TOLERANCE POWER RAMP 2.32
2.4.6.4 Configuration Menu TOLERANCE PHASE FREQUENCY 2.33
2.4.6.5 Configuration Menu BER TEST DEFINITION 2.34
2.4.6.6 Configuration Menu NETWORK DEFINITION 2.36
2.4.6.7 Configuration Menu BS SIGNAL DEFINITION 2.37
2.4.6.8 Configuration Menu RF CONNECTOR/EXT. ATTENUATION 2.38
2.4.6.9 Configuration Menu SYNCHRONIZATION 2.39
2.4.6.10 Configuration Menu RF SIGNAL GENERATOR 2.40

Supplement to Operating Manual CMD52/CMD55

Information on Software Version V1.60

1.) Configuration Menu "NETWORK DEFINITION"

NCC (Network Colour Code) cannot be changed.

2.) Module Test Menu "BURST ANALYSIS"

Menu "ADDITIONAL MEASUREMENT" cannot be called from this menu (alternative: activated from menu "RF GENERATOR" or menu "SELECTION").

3.) Menu "RF GENERATOR"

RF frequencies cannot be entered in or converted into channel numbers.

4.) Operation "Autotest"

In "Autotest" operation, no remote control commands (RS232 or IEC bus) may be sent to the CMD.

5.) Configuration Menu "RF CONNECTOR/EXT. ATTENUATION"

If the second RF input (RF IN2) is overloaded, the CMD stops.

The maximum input level possible for full dynamic range of the second input is 0 dBm. There is a danger of destruction for levels higher than +13 dBm.

In the case of mobiles with a maximum output power of +43 dBm, an external attenuation of at least 43 dB (ohmic attenuator pads and/or coupling attenuation by means of antennas) is thus necessary.

In the case of handies with a maximum output power of +33 dBm, an external attenuation of at least 33 dB is necessary.

6.) Operation "Autotest" with Channels that Can Be Configured

The BCCH channel and the TCH channels can be changed in the first two start menus of the autotest by means of hardkey "CONFIG".

2 Manual Operation

Despite its many facilities, the Digital Radiocommunication Tester CMD permits easy and convenient operation, which is also supported by the use of menus.

The clear front-panel layout permits fast access to the controls and connectors.

If you are not yet familiar with the CMD and want to get a fast overview of its capabilities, you should first read section 2.1, which will lead step by step through a complete test on a GSM mobile phone.

Section 2.4 describes the complete functions of manual operation. Starting from the selection menu, all menus are explained completely one after the other.

2.1 Getting Started

Section 2.1 has been designed mainly for the newcomer to the CMD. It leads the operator step by step through the most common tests which are performed on GSM mobile phones.

It includes connection of the phone, the steps location update and call setup as well as the individual tests.

Each individual step additionally includes pointers e.g. ❶ to more detailed information on the opposite page.

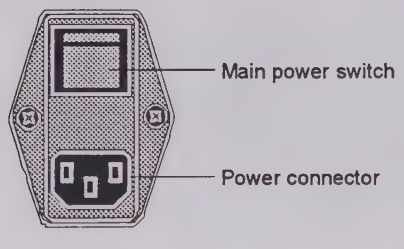
The layout and contents of this section are application oriented and contain, in addition to information specific to the CMD, information relating to the GSM system.

In order to quickly become aquainted with the CMD and its numerous features we suggest to read through this section whilst at the same time operating the CMD together with a mobile phone.

The user will thus quickly and easily get to know the extremely user-friendly concept of the CMD and will therefore very soon achieve correct and usable measurement results.

For further information on the individual menu illustrations and keys kindly refer to the reference part starting with section 2.2.

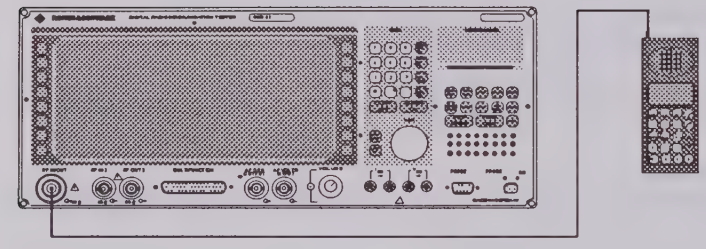
2.1.1 Manual Tests: Connecting the Mobile to the CMD



Step 1

Plug the power cable into the power connector at the rear of the instrument and connect the CMD to the current supply. ❶

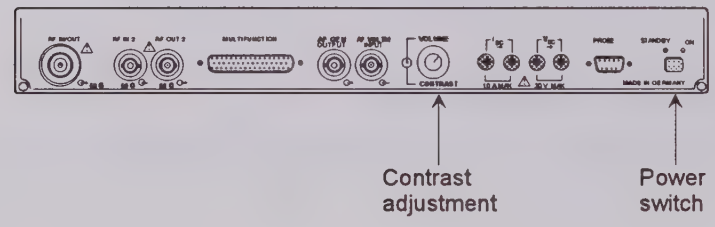
Switch the CMD to standby mode using the main power switch at the rear. ❷



Step 2

Connect the N-type connector RF IN/OUT of the CMD to the antenna connector of the mobile phone. ❸

Supply the mobile phone with the correct operating voltage (battery or power supply). ❹



Step 3

Switch on the CMD by means of the power switch on the front panel. ❺

Adjust the display contrast as desired. ❻

The CMD now shows the opposite display and is ready to test the mobile phone.

Additional Information

Step 1

❶ Power supply
The CMD is equipped with a supply voltage identification facility and automatically adjusts itself to the supply voltage applied. (Range: AC voltage 90 to 132 V and 180 to 265 V; 47 to 440 Hz).

❷ Main power switch on the rear panel
When the power switch on the rear panel is set to the OFF position, the complete instrument is disconnected from the power supply. When the main power switch is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch on the front panel.

Step 2

❸ RF connection of the mobile phone
A high-quality cable should be used for this connection, ideally with an attenuation of less than 0.5 dB. For portable phones (handys), the car installation set supplied by telephone manufacturers can be used.

❹ Power supply for the mobile phone
In case the mobile phone is supplied from an external power supply, make sure that it is capable of supplying the maximum peak current required. As GSM mobile phones generate pulse-like RF signals, they often feature a pulse-shaped current consumption. Problems may arise if power supplies are used which cannot provide such currents with a constant voltage.

Step 3

❺ Power switch on the front panel
The power switch at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the yellow LED (STANDBY) is illuminated.

Operation:
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

❻ Contrast
The display contrast can be adjusted using the rotary knob CONTRAST on the front panel. The contrast adjustment depends on the viewing angle of the user and can be readjusted if the viewing angle changes.

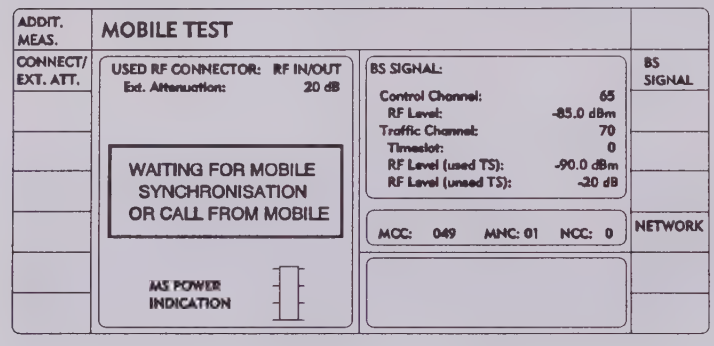
2.1.2 Manual Tests: Setting up a Call to the Mobile Phone

Step 1

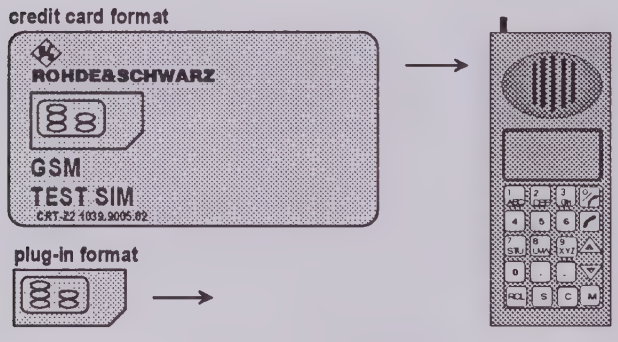
Select

MANUAL TEST

to perform a manual test. ❶



The CMD is now transmitting and is waiting for the mobile phone to synchronise with the signal (Text "WAITING FOR MOBILE SYNCHRONISATION OR CALL FROM MOBILE" blinks). ❷ ❸

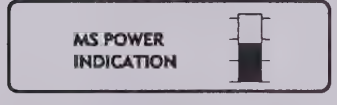


Step 2

Insert a test SIM card of the appropriate size into the phone and switch on. ❹ ❺

If requested, enter the PIN number followed by #.
(PIN No. of Rohde & Schwarz test SIM card: 0000). ❻

The blinking text indicates that a location update is taking place between the CMD and the mobile phone. ❼



The vertical bar indicates that the CMD is receiving an RF signal from the mobile phone. ❽

Additional Information

Step 1

❶ **Manual Test**
After selecting Manual Test the CMD changes the display and, after a few seconds, starts to transmit a control channel. In the GSM specifications, this is known as a C0 carrier, containing a Broadcast Channel or BCCH. In this case, the term control channel is used for simplicity and to maintain continuity for people used to testing mobile phones of analog cellular networks.

❷ **Control Channel**
The control channel is used by GSM to handle the first communication between the base station and the mobile phone. After switching on, the mobile phone searches for the control channel, synchronises to it and decodes the information contained.

❸ **Changing control channel parameters**
The control channel is transmitted by the CMD on the RF channel and with the power indicated at the top right of the display. These parameters can be changed by pressing the "BS SIGNAL" softkey and entering the new parameters. For example press "RF CHAN", enter a new channel number on the numerical keypad and press the ENTER key. Pressing of the MENU UP key permits to return to the original menu again.

Step 2

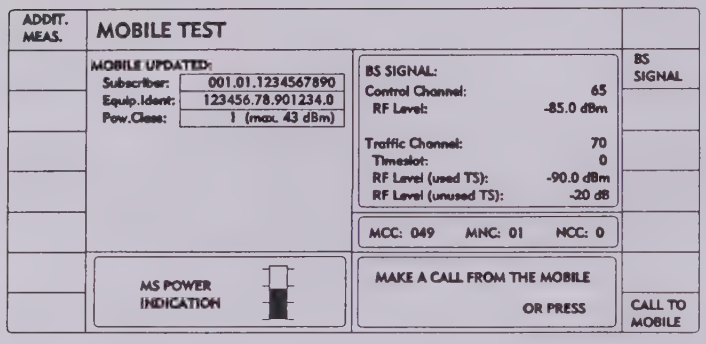
❹ **SIM Card**
Two types of SIM card are specified for use in the GSM system, one the size of a credit card and the considerably smaller plug-in SIM of about 15 x 20 mm. One SIM card must be inserted in the mobile phone in order to set up a call. However, it is also possible to make an emergency call without any card by entering 112.

❺ **TEST SIM Card**
Most mobile phones require a so-called test SIM card in order to test the sensitivity (BER, Bit Error Rate) in a test mode. A test SIM card is available from Rohde & Schwarz with the designation CRT-Z2 (ident no. 1039.9005.02). It features credit card size and can be easily converted to "plug-in" format.

❻ **PIN Number**
Be very careful when entering the PIN number as only three false tries are allowed before the card is automatically blocked. It can be unblocked by entering the PUK number which is either known or can be obtained from the company that issued the card. See also the appropriate section in the operating manual of your mobile phone.

❼ **Location Update**
The information transmitted by the CMD on the control channel requests the mobile phone to perform a location update procedure after switching-on. This is similar to a registration in analog networks and serves to inform the base station that a certain mobile has been switched on now and is available for calls. If the mobile phone is already switched on and updated, it will indicate "Service" and wait. In this case, either switch off the mobile phone or continue a call setup. The CMD will react accordingly.

❽ **Analog RF Power Indicator**
The analog bar in the CMD display indicates whether the CMD is receiving RF power of the mobile phone. The indicator features a fast reaction time and a hold function so that even short pulses are detected reliably and indicated. This is particularly useful if the mobile phone does not perform a location update or a call setup. In this case, it is possible to determine immediately whether the mobile is transmitting or not; e.g. there may be a problem in signalling or in the modulation.



As soon as a location update has been successfully completed, the display will change to the next menu level automatically.
❶

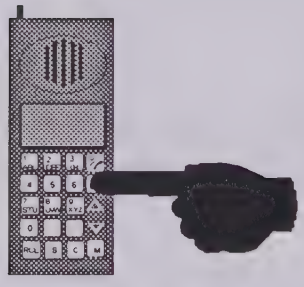
MOBILE UPDATED:

Subscriber:	001.01.1234567890
Equip.Id:	123456.78.901234.0
Pow.Class:	1 (max. 43 dBm)

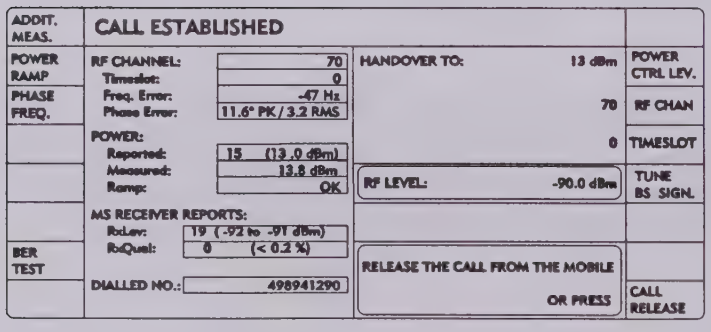
Information on the mobile phone is displayed to the left of the display.
❷❸❹

Step 3

It is now possible to call the mobile phone by pressing the appropriate key.❺❻



Alternatively, a call can be set up from the mobile phone. The CMD will react accordingly.
❺❻



In both cases, the display will change to the next menu.

Additional Information

❶ **Location Update not Successful**

If the mobile does not attempt to perform a location update, it is possible that the network simulated by the CMD does not correspond to that searched for by the mobile phone according to the SIM card used. In this case, the parameters can be matched.

Changing the CMD Network Parameters

By pressing the NETWORK softkey, the "Mobile Country Code" (MCC) and the "Mobile Network Code" (MNC) transmitted by the CMD on the control channel can be changed. To enter the value for Germany, e.g., select "MCC", enter 262 on the numerical keypad and press ENTER. The MENU UP key permits to return to the original menu. When using the Rohde & Schwarz test SIM card, enter MCC = 1 and MNC = 1.

Network Selection in the Mobile Phone

It is also possible that the mobile phone automatically accepts all MCC and MNC codes transmitted, irrespective of the SIM card (automatic network selection). However, manual selection is also possible. To this end, the mobile phone displays a list of all available networks and waits to be instructed which to use. The procedure used varies from mobile to mobile. Please read the appropriate section of the operating manual for more details.

❷ **Subscriber Number**

The international subscriber number or IMSI (International Mobile Subscriber Identity) is read from the SIM card. It consists of three fields:

- A three-digit Mobile Country Code (MCC) used to indicate the "HOME" country of the card.
- A two-digit Mobile Network Code (MNC) used to indicate the "HOME" network.
- The Mobile Subscriber Identification Number (MSIN), which may be up to ten digits long, used to clearly identify a subscriber within a network.
  The values for the Rohde & Schwarz test SIM card are: 001 01 0000000001.

❸ **Equipment Id.**

The Equipment Id. or IMEI (International Mobile Equipment Identity) is stored in the mobile hardware. It consists of four fields.

- Type Approval Code (TAC), six digits, allocated by type approval authorities.
- Final Assembly Code (FAC), two digits, identifies the manufacturer.
- Serial Number (SNR), six digits, unique number within TAC and FAC.
- Spare (SP), one digit, not yet used.

❹ **Mobile Power Class**

All mobile phones belong to a particular power class which indicates the maximum output power available from the mobile:

Power Class 1 = 43 dBm	Power Class 2 = 39 dBm	Power Class 3 = 37 dBm
Power Class 4 = 33 dBm	Power Class 5 = 29 dBm	

Step 3

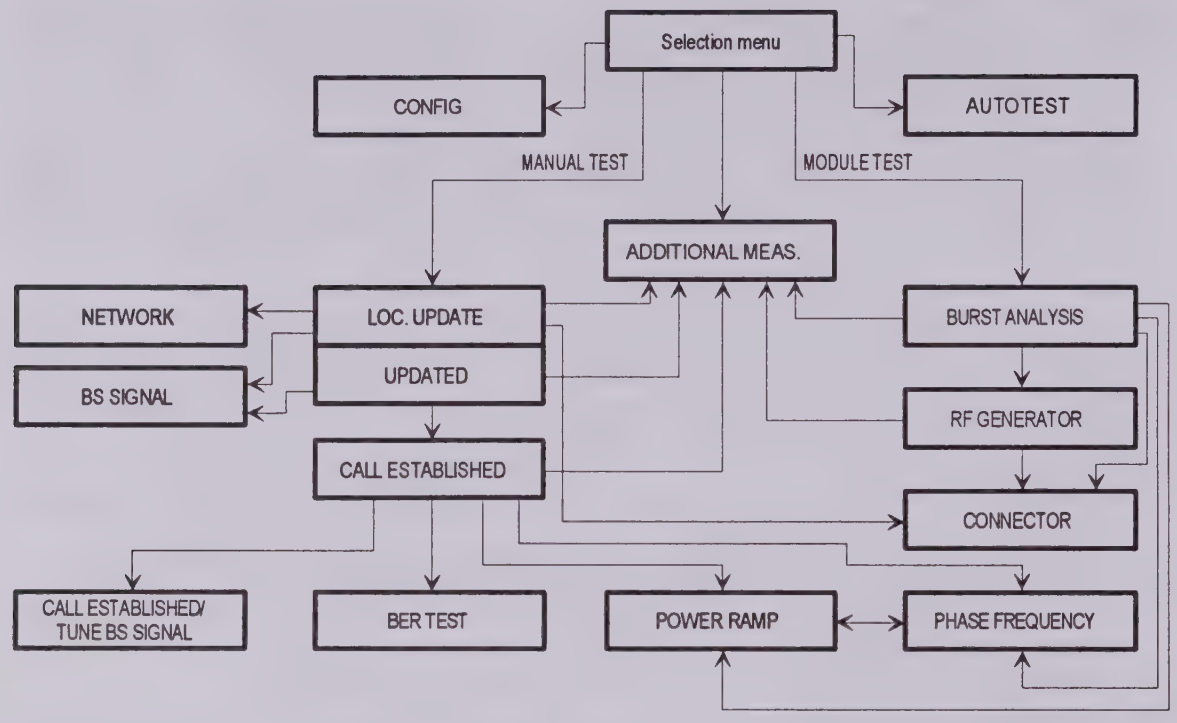
❺ **Changing Traffic Channel Parameters**

A call is set up on a traffic channel. The RF channel and the transmitting level of the CMD can be seen on the right; these values can be changed. For example, select "BS SIGNAL" and "TIMESLOT", enter the digit 7 and press ENTER to change the timeslot to 7.

❻ **Used and Unused Time Slot Levels**

The levels of the used and unused timeslots can be set separately in order that base stations can be simulated with constant or different output levels. In the GSM test "Adjacent Timeslot Rejection", the adjacent time slot level is set to a higher value than the used time slot level in order to test whether the mobile receiver can adapt quickly to fast level changes.

2.2 Menu Structure



2.3 Basic Steps of Operation

Numerical entry (VAR spinwheel permissible)

With the softkey on a bright background, no entry is possible. Pressing of the softkey causes the softkey to be displayed on dark background and a small VAR symbol to appear, indicating that the VAR spinwheel can be used.

1) Rotation of the VAR spinwheel directly increases or reduces the setting value.

2) Pressing the first numerical key causes an input window to be opened, which already displays the first digit. The small VAR symbol is masked, the spinwheel variation can no longer be used. Then further digits can be entered. BACKSPACE deletes the last digit, CLEAR is used to clear the complete entry, STOP BREAK causes the input window to be closed without recording the value. Terminating the entry with ENTER or a unit key causes the desired value to be set, the input window to be closed and leaves a softkey labelled in inverted form and featuring the VAR symbol. Spinwheel variation is now possible again. Press any other softkey or the ENTER key or the same softkey to render this softkey inactive, which is shown by the softkey being displayed on bright background.

3) Units:

a) The entry of numerical values can be terminated by pressing the unit key.
[1] [5] [dBm] ⇒ 15 dBm

b) When using the ENTER key, the currently provided unit is used again.
[1] [7] [ENTER] ⇒ 17 dBm

c) For parameters without units, e.g. "power stages", there are no specific unit keys. Either the ENTER key or a forbidden unit key can be used to terminate the entry.

[1] [4] [Hz or kHz or MHz] ⇒ Power stage 14

forbidden unit keys

[1] [5] [ENTER] ⇒ Power stage 15

d) Conversion of units is accomplished by pressing the respective (forbidden) unit key.

Power stage 15	[dBm]	⇒ 13 dBm
13 dBm	[Hz]	⇒ Power stage 15
5000 Hz	[kHz]	⇒ 5.000 kHz

1 out of n selection with softkeys

n softkeys describe n different possible operating modes.
One of the n possibilities is always active, marked by inverse display.

Loop Toggle

Two (or several) operating states are faded in next to a softkey. The softkey being active is marked by inverse display. Changing of the operating state is effected by (repeated) pressing of the softkey.

Hardkeys

[CONFIG]

In addition to the measurement menus, a number of configuration menus are provided, which permit to specify and vary parameters for measurements as well as basic settings. These configuration menus can be selected directly via the "CONFIG menu tree" on the one hand; on the other hand, it is possible to press the CONFIG key in a measurement menu and subsequently press a softkey to call the configuration menus associated with this measurement menu.

[MENU UP]

This key permits to change to the next higher menu. For example, it is thus possible to leave configuration menus or partial submenus.

[MENU HOME]

This key permits to return directly to the selection menu.

2.4 Description of the Menus

After switching on of the instrument, the selection menu is displayed. After selecting the operating mode, the main topics for measurements provided by the instrument can be selected.

2.4.1 Selection Menu

Fig. 2.4-1 Selection menu

ADDIT. MEAS. Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

MANUAL TEST Selection of the MOBILE TEST menu. In this menu, the GSM/PCN mobile phone test is started (manual operation). The CMD simulates a base station (full signalling), (see section 2.4.2).

MODULE TEST This main menu permits to perform measurements on modules and measurements on GSM/PCN mobile phones in service mode (see section 2.4.5).

AUTO TEST Selection of the AUTO TEST menu. Automatically running measurements on GSM/PCN mobile phones can be performed here.

GSM

Switchover between GSM and PCN (DCS-1800) mode, only applies to model 55.

DCS-1800

Switchover between GSM and PCN (DCS-1800) mode, only applies to model 55.

CONFIG MENU

Selection of configuration menus (see section 2.4.6.1).

Specifications of GSM and PCN (DCS-1800)

	GSM	PCN (DCS-1800)
Frequency range MS ⇒ BS	890...915 MHz	1710...1785 MHz
Frequency range BS ⇒ MS	935...960 MHz	1805...1880 MHz
Duplex spacing	45 MHz	95 MHz
Channels	1...124	512...885
Channel spacing	200 kHz	200 kHz

2.4.2 Manual Test

2.4.2.1 MOBILE TEST Menu (Wait Location Update)

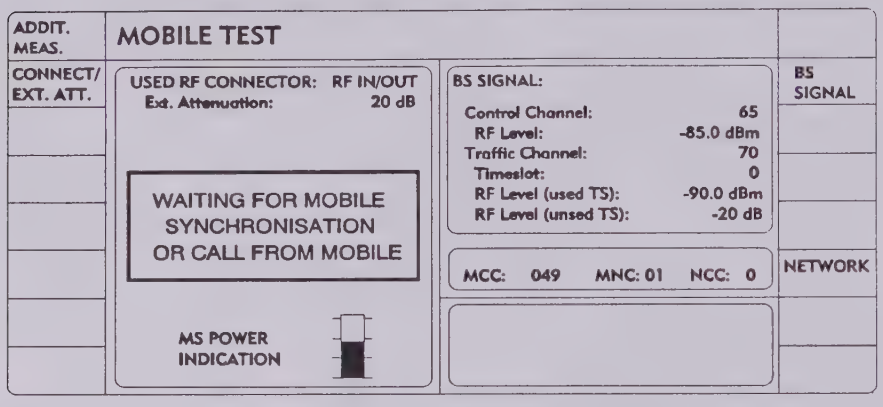


Fig. 2.4-2 MOBILE TEST menu (Wait Location Update)

After selection of the main menu Manual Test, the CMD starts transmission on a control channel and attempts to establish a call to the mobile station. On the left side of the display, the CMD indicates with the blinking text that it is transmitting and waiting for the mobile station to respond. The power indicator below detects any activity of the mobile station and indicates it dynamically in the display. At the top right of the display, the CMD indicates the frequency channel number of the current control channel and that of the voice channel, the major parameters contained being indicated below.

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

CONNECT/ EXT. ATT.

Using this softkey, a configuration menu can be entered which permits to select the RF inputs and outputs of the CMD. If external attenuator pads are used or the test setup includes a path attenuation, attenuation values can be entered in this menu (see section 2.4.6.8).

BS SIGNAL

This softkey permits to enter a configuration menu where the physical parameters of the base station signal can be defined. This includes frequencies and level of the common control channel and the traffic channel. In the case of the traffic channel, the level of the unused timeslot can be selected in addition to the level of the used timeslot (see section 2.4.6.7).

NETWORK

Input of the network parameters:
- MCC (Mobile Country Code)
- MNC (Mobile Network Code)
- NCC (National Colour Code)

2.4.2.2 MOBILE TEST Menu (After Location Update)

After the CMD has established a call to the mobile station by way of a location update of the mobile station, this menu is displayed differently. On the left side of the display, the essential signalling data from the mobile station are displayed. Any time the power indicator detects an activity of the mobile station, it is indicated on the display. The information field on the right with the physical parameters of the BS signal is supplemented by the physical parameters of the traffic channel. At the bottom right, controls and hints as to the call to be established are displayed.

After pressing the BS SIGNAL softkey (change to BS Signal menu), the BCCH is switched off. It is thus possible that some mobiles lose synchronization if you stay in this menu too long.

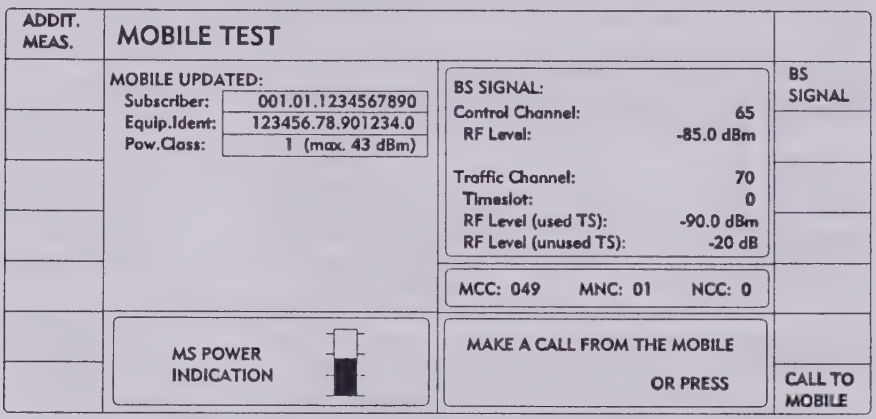


Fig. 2.4-3 MOBILE TEST menu (After Location Update)

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

BS SIGNAL

Using this softkey, a configuration menu can be entered, which permits to define the parameters of the base station signal. This includes frequencies and level of the common control channel and the traffic channel. In the case of the traffic channel, the level of the unused timeslots can be selected in addition to the level of the used timeslot (see section 2.4.6.7).

CALL TO MOBILE

Pressing of this softkey causes the CMD to establish a call to the mobile station. However, the CMD is also always prepared to establish a call when the mobile station initiates the call. In this case, the mobile station is served.

After the call has been established, the CMD enters the CALL ESTABLISHED menu.

2.4.2.3 CALL ESTABLISHED Menu

The CALL ESTABLISHED menu is the central menu in the mobile station test. It displays the most important RF measurement results and signalling parameters received by the mobile station (left half of display). In addition, the results of power ramp, phase and frequency error measurement are indicated (only with Option CMD-B4). For experiments carried out primarily on the receiver of the mobile station, various parameters of the signal sent by the CMD can be varied (softkey TUNE BS SIGN.). Besides, it is possible to vary the traffic channel frequency used, the timeslot used and the transmitter power of the mobile station (softkeys POWER CTRL LEV., RF CHAN, TIMESLOT). By pressing the POWER RAMP softkey, the power ramp measurement is started, pressing of the PHASE FREQUENCY softkey starts the phase and frequency error measurement (only with Option CMD-B4). The transmitter power of the mobile station can be varied by pressing the POWER CTRL LEV softkey. Finally, this menu permits to release the call again (CALL RELEASE softkey).

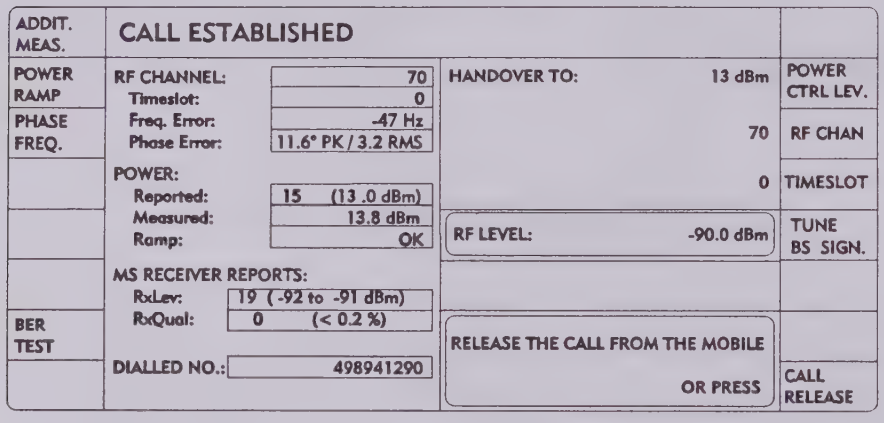


Fig. 2.4-4 Menu CALL ESTABLISHED

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

POWER RAMP

(only with Option CMD-B4)

By pressing this softkey, the power ramp measurement is started. The menu changes to the display of measurement results.

PHASE FREQ.

(only with Option CMD-B4)

By pressing this softkey, the phase and frequency error measurement is started. The menu changes to the display of measurement results.

BER TEST

(only with Option CMD-B4

This softkey permits to select a measurement menu that offers 7 different predefined bit error rate tests. These tests are characterized by statistical test parameters and physical setting parameters of the base sstation (CMD). Both can be influenced by the user so as to generate different predefined tests which can then be selected and started (see section 2.4.3.3).

POWER CTRL LEV.

Pressing of this softkey informs the instrument on the transmitter power required by the mobile station. This transmitter power is signalled to the mobile station.

RF CHAN

Pressing of this softkey informs the instrument on a new channel traffic number. This number is signalled to the mobile station and a change to this channel number is effected.

TIMESLOT

Pressing of this softkey informs the instrument on a new timeslot for the traffic channel. This timeslot is signalled to the mobile station and a change to this timeslot is effected.

TUNE BS SIGNAL

The information field next to this softkey displays the most important setting parameters of the CMD. Pressing of this softkey causes the display on the right to be replaced by operating possiblilities for the signal sent by the CMD (used and unused timeslot).

CALL RELEASE

Pressing of this softkey causes the CMD to release the call to the mobile station. However, it is prepared at any time to release a call even if this is initiated by the mobile station. In this case, the mobile station is served. After the call has been released, the CMD changes to the previous menu MOBILE TEST, from where a new call can be established.

2.4.2.4 CALL ESTABLISHED/TUNE BS SIGNAL Menu

The previous menu CALL ESTABLISHED is the starting point for most measurements. The information field next to the TUNE BS SIGN. softkey indicated the most important setting parameters of the CMD. Pressing of this softkey caused the righthand screen display to be replaced by a complete selection of operating possibilities for the signal mixture output by the CMD, which was then displayed in this menu. The used signal is the level of the used timeslot and that of the unused timeslots.

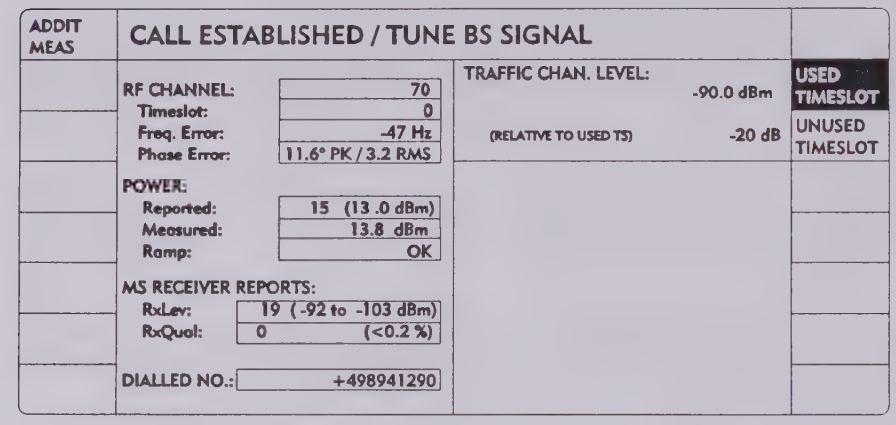


Fig. 2.4-5 CALL ESTABLISHED/TUNE BS SIGNAL menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

USED TIMESLOT

Communication between CMD and mobile station is effected on one of the 8 timeslots. (CALL ESTABLISHED menu; TIMESLOT softkey). Using this softkey the RF level of the CMD in the used timeslot is set to its absolute value.

When changing measurement parameters using the USED TIMESLOT softkey, these modifications are displayed on the left side of the screen. The mobile station measures the signal sent by the CMD and outputs the results in a test report which is displayed in the field MS RECEIVER REPORTS.

UNUSED TIMESLOT

This softkey is used to set a uniform level for the remaining timeslots. It is a relative level and refers to the level of the used timeslot.

MENU UP permits to return to the main menu CALL ESTABLISHED.

2.4.3 GSM Measurements

2.4.3.1 POWER RAMP Menu (only with Option CMD-B4)

For entering tolerances, a configuration menu is provided (see section 2.4.6.3).

The initial menu for measurements is the menu CALL ESTABLISHED or BURST ANALYSIS (module test). Here, the power ramp is represented as a function of the time.

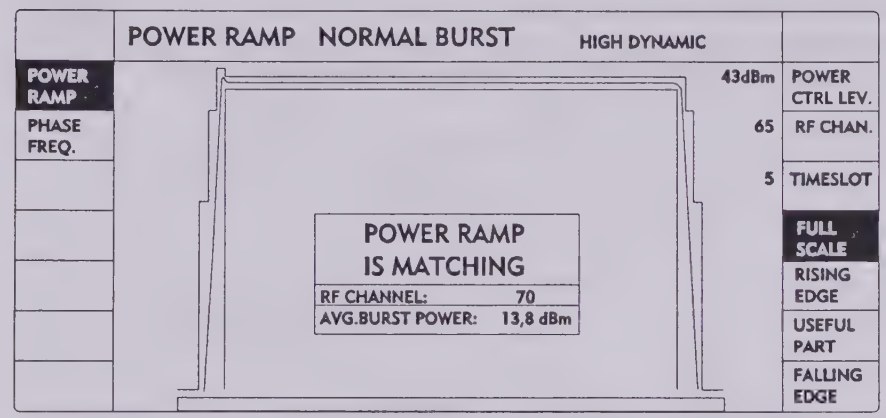


Fig. 2.4-6 POWER RAMP menu

The display in this measurement menu consists of the following items:

- Tolerance mask. The position of the tolerance mask in the direction of the power coordinate can be changed in the configuration menu.
- Reference line: It runs through the center of the horizontal center part of the tolerance mask (useful part). The average value of maximal power and minimal power during the "useful part" in the burst results in the reference line, wheras with "BURST POWER" in the text part the average is taken from all measured values during the useful part of the burst. Thus both measured values are usually similar, but not necessarily equal.
- Text part. Indicates the frequency channel on which the measurement was made as well as the value for BURST POWER:
- Overall judgement. Unless all tolerances are observed, the message "POWER RAMP IS NOT MATCHING" is displayed. The tolerance limits are exceeded if the tolerance mask is exceeded or fallen below by the measurement curve or if the position as to time of the entire measurement curve is not observed.
- Header line. With Option CMD-B42 fitted, the power ramp is measured with a high dynamic range (>72 dB). The tolerance limits of the power time template are changed then.

POWER RAMP

The power ramp measurement is started in single-shot operation or after a stop because of exceeded tolerance. Measurement stop and start in continuous mode.

PHASE FREQ.

Change to the phase/frequency error measurement.

POWER CTRL LEV.

RF CHAN

TIMESLOT

When selected from manual test
The softkeys POWER CTRL LEV., RF CHAN and TIMESLOT have the same function as in the CALL ESTABLISHED menu (see section 2.4.2.3).

EXP. POWER

RF CHAN

When selected from module test:
The softkeys EXP. POWER and RF CHAN have the same function as in the BURST ANALYSIS menu (see section 2.4.5.1).

FULL SCALE

Display of the complete power ramp.

RISING EDGE

The rising edge of the power ramp is displayed (zoom function).

USEFUL PART

The active part of the timeslot is displayed with a higher resolution (zoom function).

FALLING EDGE

The falling edge of the power burst is displayed (zoom function).

2.4.3.2 PHASE FREQUENCY Menu (only with Option CMD-B4)

For entering tolerances, a configuration menu is provided (see section 2.4.6.4).

In this measurement menu, the phase error of the modulation is displayed as a function of the time and the peak phase error, the RMS phase error and the frequency offset are indicated in measured values.

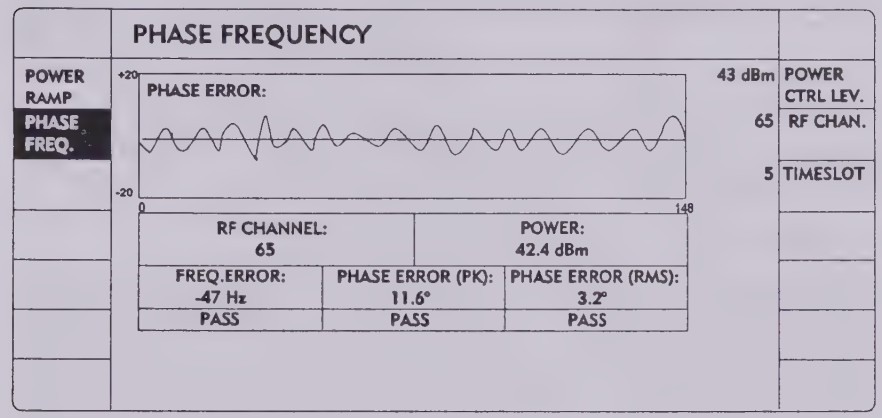


Fig. 2.4-7 PHASE FREQUENCY menu

The display is divided into several fields:

The upper field indicates the phase error during the burst.

The centre field contains the measurement parameters frequency channel and power. The measurement results belonging to this menu are the frequency error and the phase error, indicated as peak value and average value.

The PASS/FAIL evaluation field is located below.

POWER RAMP — Change to the POWER RAMP menu.

PHASE FREQ. — The phase/frequency error measurement is started in single-shot operation or after a stop because of exceeded tolerance. Stop and start of the measurement are in continuous mode.

POWER CTRL LEV.

RF CHAN.

TIMESLOT

When selected from the manual test:
The softkeys POWER CTRL LEV., RF CHAN and TIMESLOT have the same function as in the CALL ESTABLISHED menu (see section 2.4.2.3).

EXP. POWER

RF CHAN.

When selected from the module test:
The softkeys EXP. POWER and RF CHAN have the same function as in the BURST ANALYSIS menu (see section 2.4.5.1).

2.4.3.3 BIT ERROR RATE Menu (only with Option CMD-B4)

Test parameters can be set in the configuration menus (see section 2.4.6.5).

This measurement menu is selected by pressing the BER TEST softkey in the CALL ESTABLISHED menu. Various receiver tests based on the bit error rate test are selected in this menu. This test requires a special SIM CARD (R&S GSM test SIM CRT-Z2), which allows the RF loopback at the mobile station (bits sent by the CMD are received by the mobile station, demodulated and sent back on the RF path). Otherwise, the RF loopback is automatically set by calling this test. The 7 different tests to be selected here differ by different stimuli (RF signals sent by the CMD) and by different evaluation criteria. These are mainly the number of frames via which the bit errors occurred or the number of erased frames are evaluated. The stimuli and the evaluation criteria used in this test can be selected in the CONFIG menu. This menu permits to start the different tests only with softkeys USER 1 to USER 7. These tests all have a finite measuring time, do not permit parameter variations during the test and supply a pass/fail result at the end. The test under softkey CONT.BER MEAS is an exception. It allows variation of test parameters and the measured values are indicated continuously (see CONTINUOUS BIT ERROR RATE).

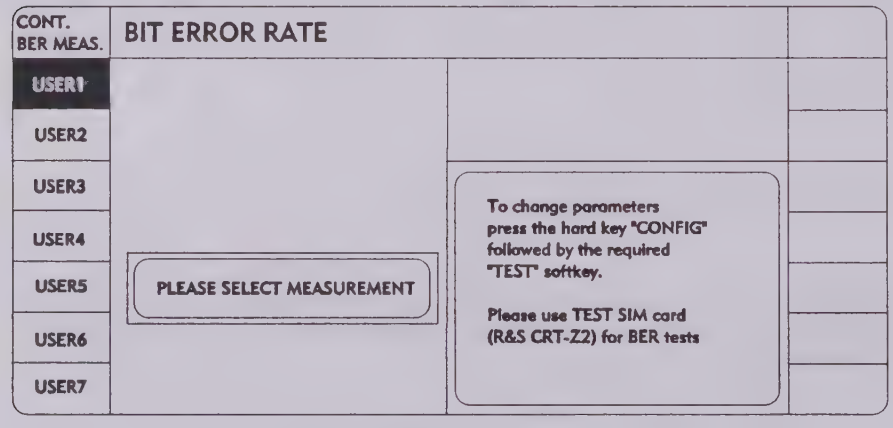


Fig. 2.4-8 BIT ERROR RATE menu

2.4.3.4 BIT ERROR RATE Menu (USER 1...USER 7)

One of these menus is entered after selection of one of the 7 user-specific test menus.

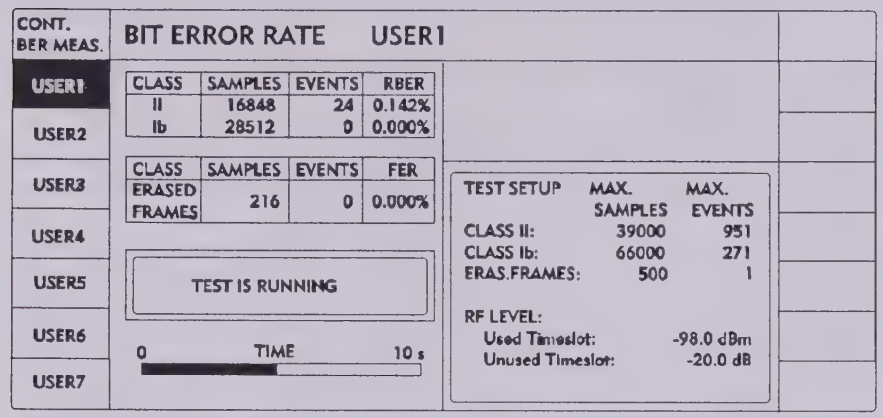


Fig. 2.4-9 Menu BIT ERROR RATE USER 1

CONT. BER MEAS.

Selection of the continuous bit error rate test.

USER 1

to

USER 7

Selection and start of a user-specific test menu.

Display

The measurement results are recorded at the top left of the display. A box is displayed there in the bit error rate measurement. It contains a line each for the unprotected bits (class II) and for the protected bits (class Ib). The bits sent by the CMD are referred to as samples and are counted. A bit which has been received wrongly is designated as an event, the events are also counted. The ratio of bits received wrongly related to all received bits is called bit error rate (BER) and indicated in % in the last column, separated according to class II und Ib.

If the test is a residual bit error rate test (RBER), the bits sent are additionally combined in frames. In this case, two boxes containing measured values are visible. The frames sent are again designated as samples and counted as well. The frames that cannot be corrected are referred to as events and also counted. The ratio of erased frames to all frames sent is the frame erasure rate (FER) indicated in % in the last column. In the case of an RBER test, the numbers of the first box must be interpreted in a somewhat different way. The bits belonging to erased frames are neither counted with the samples nor with the events so that the ratio of events to samples with respect to the bits is not concerned by the faulty frames; hence the name residual bit error rate.

The elapsed and remaining test time is indicated at the bottom left. At the end of the test, the result is commented with a pass/fail result. This pass/fail criterion is defined in the CONFIG menu.

2.4.3.5 CONTINUOUS BIT ERROR RATE Menu

Contrary to the 7 bit error rate tests mentioned before, which were limited in duration and supplied a definite result at the end, the continuous bit error rate test is a bit error rate test of arbitrary length. It can be used to observe the dependency of the bit error rate on the stimuli, that is to say on the signals the CMD sends to the mobile station, in an experiment.

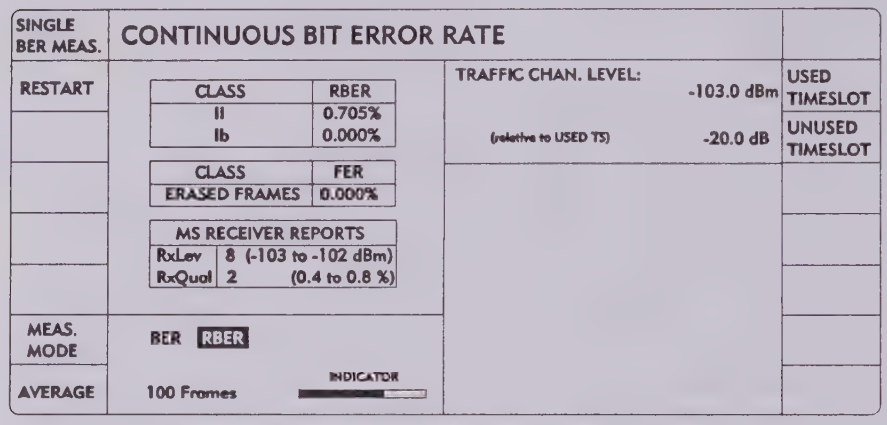


Fig. 2.4-10 CONTINUOUS BIT ERROR RATE menu

SINGLE BER MEAS.

This softkey permits to return to a bit error rate measurement limited in time.

RESTART

This softkey can be used to restart a bit error rate test. Due to an averaging period selected using the AVERAGE softkey the measurement results in the result field contain many previous components. On pressing RESTART; the test immediately forgets the previous values and starts anew.

MEAS. MODE

This softkey permits to switch between the two measurement modes BER and RBER.

AVERAGE

This softkey is used to enter the averaging period in frames.

USED TIMESLOT

Communication with the radiophone is effected on one of 8 timeslots (CALL ESTABLISHED menu; TIMESLOT softkey). Using this softkey, the RF level of the CMD in the used timeslot is set to its absolute value.

UNUSED TIMESLOT

This softkey is used to set a uniform level for the remaining timeslots. It is relative and related to the level of the used timeslot. For setting the levels of the used timeslot and the unused timeslot there are certain dependencies.

Display

The field at the top left contains the measurement results, which are updated continuously. The uppermost box is to be interpreted similarly as in the BER test described before. The only difference is that no samples and events are counted because these measured values are not interesting due to the infinite duration of this text.

The center box only appears if the operating mode residual bit error rate test is running.

The lower box shows the measurement results of the MS receiver. They are the level received (RX LEVEL) and the signal quality received (RX QUAL). These two values reflect the stimuli the CMD supplies for this test and represents on the right side of the screen at the position of the MS receiver.

The field at the bottom left indicates the operating mode of the test, the number of frames from which the measurement results indicated above are obtained (AVERAGE) and an indicator. The latter has the following meaning: After a start or RESTART, the indicator field is empty and begins to fill. As long as it has not been completely filled, the measured values indicated above do not relate to the full number of frames, the degree to which they are filled approximately indicates how high the number has already become. When the indicator is completely filled, the measurements relate to the full number of frames.

The two fields on the righthand side show the setting parameters of the test signals the CMD supplies in this test. They have been written into using softkeys USED and UNUSED TIMESLOT.

2.4.4 Conventional Measurements

2.4.4.1 ADDITIONAL MEASUREMENTS Menu

The DC voltage result and several DC current results are displayed in this menu. Besides, AF measurements are possible (only with Option CMD-B41). The menu can be entered from different menus (see section 2.2, Menu Structure).

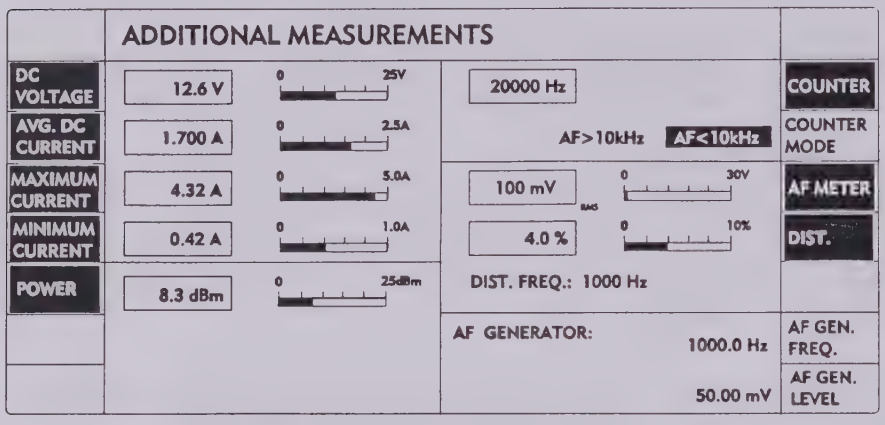


Fig. 2.4-11 ADDITIONAL MEASUREMENTS menu

The lefthand side of the menu can be used to examine the supply of the mobile station. As the RF power of the mobile station pulses, the operating current pulses as well in general. For this reason the CMD distinguishes between min, max and average value. The function AVG. DC CURRENT permits a real measurement of the current consumption which is not guaranteed in pulse operation using conventional current meters.

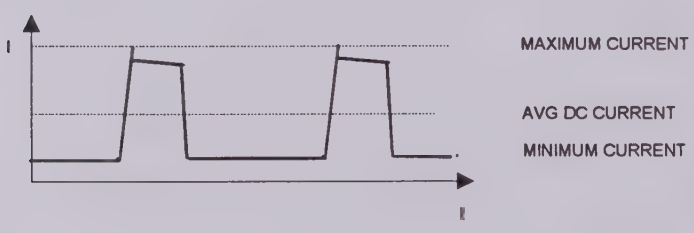
DC VOLTAGE — DC voltage result (permits the measurement of the true (thermal) power consumption together with AVG. DC CURRENT).

AVG. DC CURRENT — Average DC current drain (permits the measurement of the true (thermal) power consumption together with DC VOLTAGE).

MAXIMUM CURRENT — Maximum DC current drain (current consumption during the active burst).

MINIMUM CURRENT — Minimum DC current drain (current consumption while the mobile station is passive).

POWER — Power measurement at the RF IN/OUT socket.



Graphical representation of the DC current measurement results

General notes on the current measurements

The physical minimal value (MIN.DC) or maximal value (MAX.DC) of the measured current is evaluated. As a result of this, the display is inverted when the polarity is reversed.

Example:	AVG.DC	0.5 A	-0.5 A
	MAX.DC	1.5 A	-0.3 A
	MIN.DC	0.3 A	-1.5 A

The average display uses a time constant adapted to the GSM frame clock. Therefore, single unsynchronized current bursts may cause the average measurement to be delayed with respect to the two other measurements. However, this does not result in a faulty statement on the actual current consumption of the test item.

Example:	AVG.DC	0.5 A
	MAX.DC	0.35 A
	MIN.DC	0.31 A

These displays can be seen shortly after a single current consumption peak.

The righthand side of the menu permits to perform AF measurements (only with Option CMD-B41).

COUNTER	Frequency measurement of input signals at the "AF VOLTM" socket.
COUNTER MODE	Switchover of frequency counter mode. Counting of AF signals up to 10 kHz or IF signals up to 60 MHz.
AF METER	Level measurements of input signals at the "AF VOLTM" socket.
DIST.	Distortion measurement of input signals at the "AF VOLTM" socket.
AF GEN. FREQ.	Setting the frequency of the AF output signal at the "AF GEN" socket.
AF GEN. LEVEL	Setting the level of the AF output signal at the "AF GEN" socket.

Notes on the AF measurements (righthand menu side)

1.) Several configuration menus are provided for setting the parameters of the AF measurements.
2.) The AF measurements cannot be selected in particular signalling states of the measuring instrument.

2.4.5 Module Test

By selecting "MODULE TEST" in the selection menu, the "BURST ANALYSIS" menu can be entered.

2.4.5.1 BURST ANALYSIS Menu

This menu permits to perform GSM-specific measurements on modules or measurements on mobiles in service mode (the Option CMD-B4 is required for a few measurements).

Input fields:
The operator can enter the input socket, the external attenuation, the expected power, the type of midamble as well as the transmitting channel of the test item.

Result fields:
As soon as the parameters of the test item are entered, the CMD triggers on an incoming power burst and subsequently indicates the average burst power, the peak power, the phase/frequency error values as well as an incorrect/correct power ramp referred to the time.

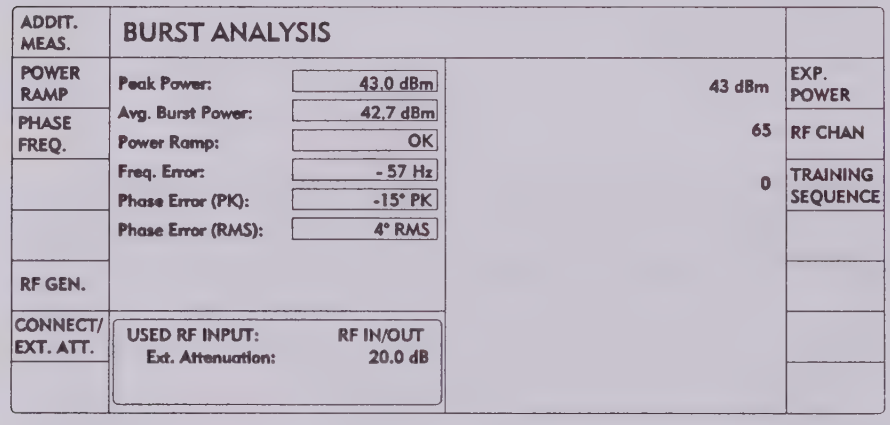


Fig. 2.4-12 BURST ANALYSIS menu

ADDIT. MEAS. — Selection of the ADDITIONAL MEASUREMENTS menu. This menu permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

POWER RAMP — Change to the "POWER RAMP" menu, where the power ramp is indicated with respect to the time (see section 2.4.3.1).

PHASE FREQ. — Change to the "PHASE FREQUENCY" menu, where the phase is graphically displayed with respect to the time (see section 2.4.3.2).

RF GEN. — Change to the "RF GENERATOR" menu, where the CMD provides an RF signal (modulated/unmodulated or pulsed/unpulsed) (see section 2.4.5.2).

CONNECT/ EXT. ATT.	Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).
EXP. POWER	Input of the expected tranmitter power of the test item.
RF CHAN	Input of the transmitter channel of the test item.
TRAINING SEQUENCE	Selection of the different types of midamble.

2.4.5.2 RF GENERATOR Menu

The CMD provides an RF signal. The parameters of this RF signal as well as the desired RF output socket can be set in this menu (lefthand side of menu).

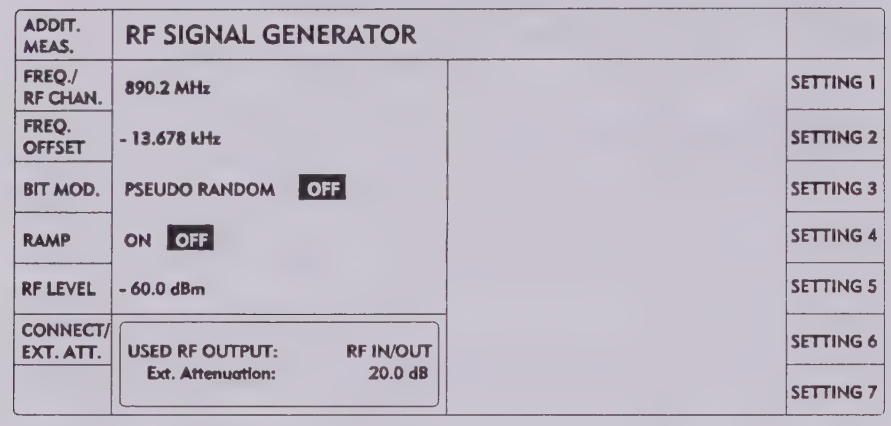


Fig. 2.4-13 RF GENERATOR menu

ADDIT. MEAS.

Selection of the ADDITIONAL MEASUREMENTS menu. It permits to perform DC voltage measurements, several DC current measurements and AF measurements (only with Option CMD-B41) (see section 2.4.4.1).

FREQ./ RF CHAN.

Input of RF frequency or RF channel. The resolution is 200 kHz (GSM/PCN channel spacing). The conversion of frequencies into channels is effected by means of the unit keys (channel corresponds to "dB"). Possible frequencies are 800 to 1000 MHz (GSM mode) or 1697.6 to 1897.6 MHz (only PCN/DCS-1800-model). When converting frequencies that lie outside the defined GSM or PCN/DCS-1800 bands, fictitious channel numbers are indicated.

FREQ. OFFSET

For achieving a more accurate fine frequency resolution, the frequency offset can be set here (resolution 33 Hz, max. ± 100 kHz).

BIT MOD.

Selection of bit modulation.
OFF: No modulation.
PSEUDO RANDOM: Modulation with a pseudo random bit sequence.

RAMP

Selection between burst or no burst of RF signal.

RF LEVEL

Input of RF level.

CONNECT/ EXT. ATT.

Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).

SETTING 1(7)

These softkeys on the righthand side of the menu permit to activate complete preset RF signal generator parameter setups by pressing only one key. These sets of parameters are preset in the configuration menus of the RF generator menu.

2.4.6 Configuration Menus

These menus offers the following ways of configuration:

- Configuration of the measuring instrument only.
- Configuration of the measuring instrument in the test setup including the GSM mobile station to be tested (e.g. consideration of external attenuator pads between test item and instrument).
- Rarely occuring operations.

There are two ways to enter the configuration menus:

- From the selection menu via the "CONFIG menu tree".
- From the different menus by pressing the CONFIG hardkey. Then the configuration menus relevant to this menu can be selected via softkeys.

2.4.6.1 Configuration Selection Menu

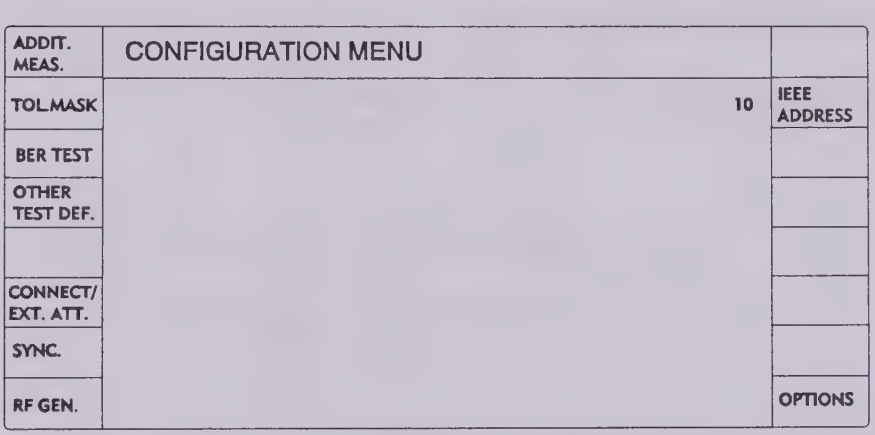


Fig. 2.4-14 CONFIGURATION Menu

ADDIT. MEAS. Change to the configuration menus for the conventional AF measurements (Option CMD-B41).

TOL. MASK Change to the configuration menus for entering the tolerance values for power ramp and phase/frequency error measurement.

BER TEST Change to the configuration menus for the different BER tests (USER 1 to 7).

OTHER TEST DEF. Change to the configuration menus for entering the network parameters and for entering the BS signal parameters.

CONNECT/ EXT. ATT. Change to the configuration menu for selecting the connectors and entering the external attenuations (see section 2.4.6.8).

SYNC. Change to the configuration menu for selecting the synchronization of the CMD with the test item (with Option CMD-B3 installed), (see section 2.4.6.9).

RF GEN. Change to the configuration menus for entering the parameter sets (setting 1 to 7) of the RF generator.

IEEE ADDRESS Input of the IEC-bus remote-control address (with Options CMD-B6 and CMD-B61 installed).

OPTIONS Display of the installed options.

2.4.6.2 Configuration Menus for ADDITIONAL MEASUREMENTS

For configuration of the AF measurements (Option CMD-B41) three menus are provided:

2.4.6.2.1 Configuration Menu AF METER

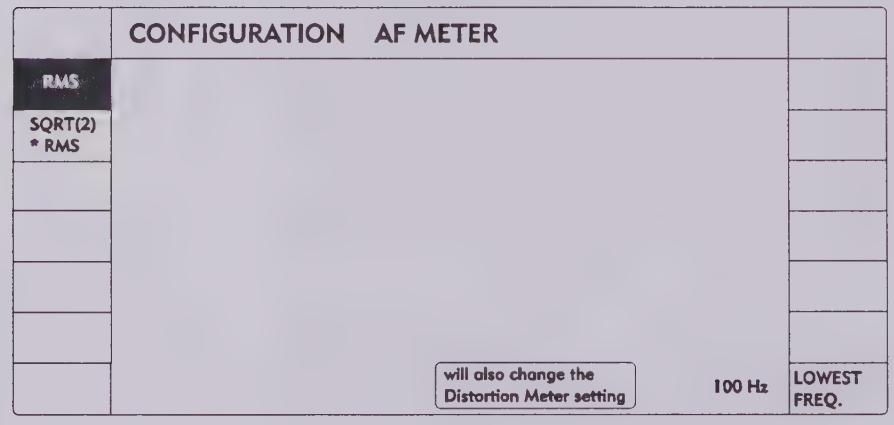


Fig. 2.4-15 CONFIGURATION AF METER menu

RMS The AF voltmeter measures RMS values.

SQRT (2) * RMS The AF voltmeter measures RMS values. However, the display is weighted with factor 1.41 (corresponds to peak value in the case of sinusoidal signal).

LOWEST FREQ. Input of the lowest AF frequency that is weighted without measuring errors. High values reduce the measuring time.
Note:
This setting also changes the limit frequency in the case of the distortion measurement.

2.4.6.2.2 Configuration Menu DISTORTION METER

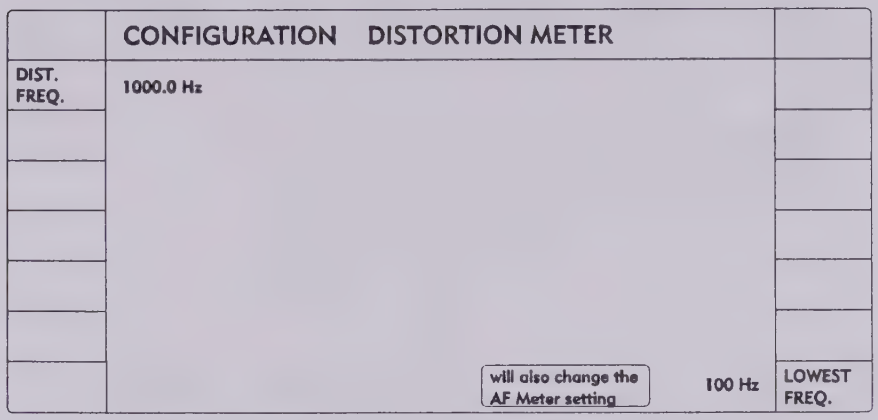


Fig. 2.4-16 Menu CONFIGURATION DISTORTION METER

DIST. FREQ.

Input of operating frequency of distortion meter (centre frequency of notch filter).

LOWEST FREQ.

Input of lowest AF frequency that is weighted without measuring errors. High values reduce the measuring time.
Note:
This setting also changes the limit frequency in the case of the AF voltmeter measurement.

2.4.6.2.3 Configuration Menu AF GENERATOR

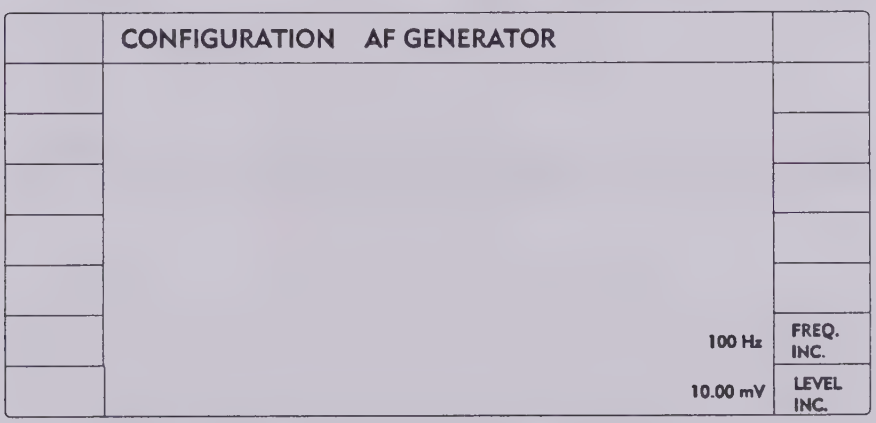


Fig. 2.4-17 Menu CONFIGURATION AF GENERATOR

FREQ. INC.

Input of increment for variation of the AF generator frequency using the spinwheel.

LEVEL INC.

Input of increment for variation of the AF generator level using the spinwheel.

2.4.6.3 Configuration Menu TOLERANCE POWER RAMP

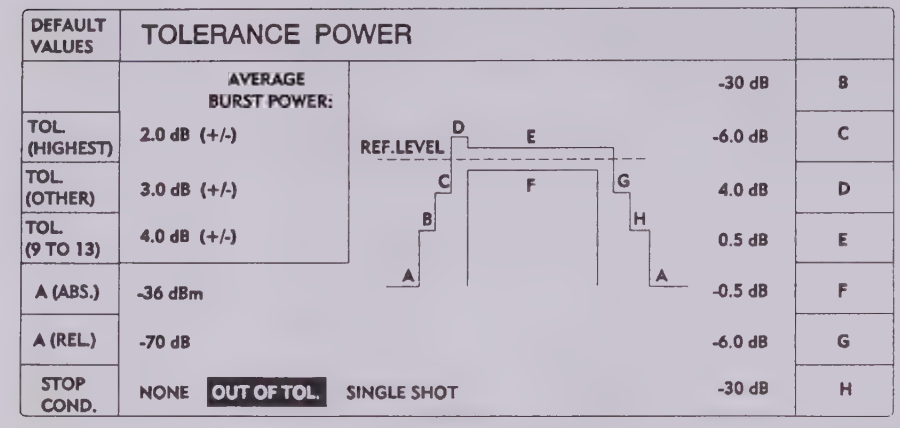


Fig. 2.4-18 Menu TOLERANCE POWER RAMP

DEFAULT VALUES

The default values complying with the GSM regulations are used as the tolerance values.

TOL. (HIGHEST)

to

H

The tolerance values of the power time template can be specified for the different ranges A to H.

Note:

The softkeys TOL. (HIGHEST) and TOL. (OTHER) do not exist if the selection is made via the module test.

Softkey TOL. (9 TO 13) only exists in the case of PCN/DCS-1800 if the selection is made via the manual test.

STOP COND.

This softkey permits to change between the operating modes continuous measurement, stop after exceeded tolerance and single measurement.

2.4.6.4 Configuration Menu TOLERANCE PHASE FREQUENCY

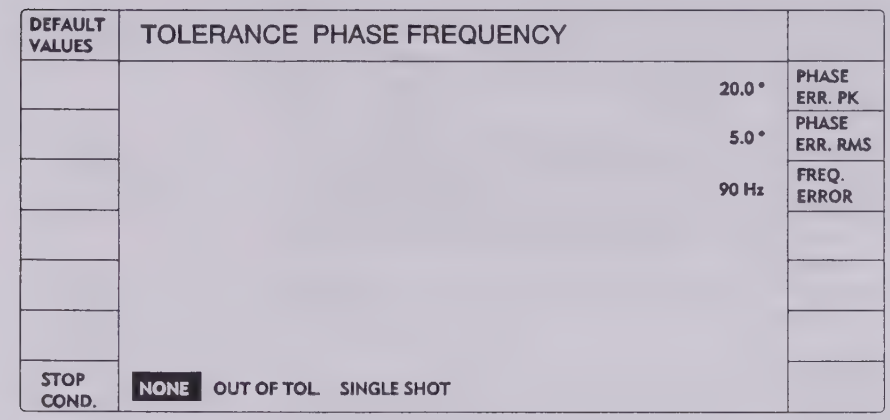


Fig. 2.4-19 TOLERANCE PHASE FREQUENCY menu

DEFAULT VALUES

The default values complying with GSM regulations are used for the tolerance values.

STOP COND.

This softkey permits to change between the operating modes continuous measurement, stop after exceeded tolerance and single measurement.

PHASE ERR. PK

to

FREQ. ERROR

The tolerance values of the phase error (peak value and rms value) and of the frequency error can be entered here.

2.4.6.5 Configuration Menu BER TEST DEFINITION

The 7 tests are identical with respect to their structure. They may differ in the stimuli and evaluation criteria by different user configurations.

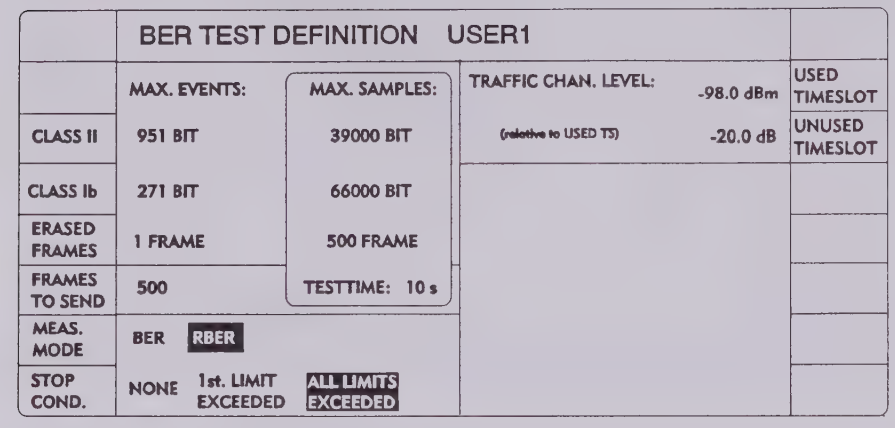


Fig. 2.4-20 BER TEST DEFINITION menu

Fig. 2.4-20 shows a bit error rate test of individual configuration. The stimuli generated by the CMD for this test are to be seen on the right side of the screen, the evaluation criteria on the left side.

The two modes of measurement Bit Error Rate (BER) and Residual Bit Error Rate (RBER) are to be explained first. In the case of the BER test, errors with the unprotected bits (class II) and with the protected bits (class Ib) are counted. The bits sent by the CMD are designated as samples and also counted, a wrongly received bit is referred to as event and also counted. The ratio of bits received wrongly with respect to all bits set is designated as Bit Error Rate (BER).

In the case of the residual bit error rate test (RBER), the bits sent are additionally combined in frames. The frames sent are again designated as samples and counted, the erased frames are designated as events and counted as well. The ratio of erased frames to all frames sent is the frame erasure rate (FER). In the case of an RBER test, the Class I and Class II events have to be interpreted in a somewhat different way as well. The bits belonging to erased frames are neither counted with the samples nor with the events, so that the ratio of events to samples with respect to the bits is not concerned by the faulty frames.

CLASS II

CLASS Ib

These softkeys are used to enter the maximum number of permissible bit errors according to classes. The bits sent in this test are indicated on the right for comparison. They represent the reference value for the bit error rate with the BER test. If there are erased frames in an RBER test, they are no reference for the residual bit error rate, as bits from erased frames are not counted, but listed here.

ERASED FRAMES

This softkey is only significant if the residual bit error rate is measured. An entry here describes the maximum number of erased frames in this test. The total number of frames is shown next to the entry for comparison. It is the reference value for the frame erasure rate (FER).

FRAMES TO SEND

This softkey determines over how many frames the test extends. This requires a certain test time the CMD calculates and indicates as well. As every frame contains exactly 132 Class Ib bits and 78 Class II bits, the total number of bits concerned is also displayed separated according to classes.

MEAS. MODE

This softkey permits to switch between the two measurement modes BER and RBER.

STOP COND.

This softkey determines when the test is to be aborted before reaching the required number of frames. There are three possibilities:

NONE
The test runs over the specified number of frames, irrespective of how many errors occur. However, it can be manually aborted using the STOP/BREAK key.

1st LIMIT EXCEEDED
The test is aborted when the first of the error limits indicated is reached. These are, alternatively, two different upper limits in the BER test (test runs until Max Events Class Ib or Max Events Class II has been reached) and three in the RBER test (Max Events with respect to frames in addition).

ALL LIMITS EXCEEDED
The test is only aborted before the end if all error limits have been exceeded at an early point of time.

The stimuli generated by the CMD are programmed for the test using the following softkeys:

USED TIMESLOT

Communication with the radiophone is performed on one of 8 timeslots (CALL ESTABLISHED menu; TIMESLOT softkey). This softkey is used to set the RF level of the CMD in the used timeslot to its absolute value.

UNUSED TIMESLOT

This softkey permits to set a uniform level for the remaining timeslots. It is relative and refers to the level of the used timeslot. There are certain dependencies for the setting of the levels of the used timeslot and the unused timeslot.

2.4.6.6 Configuration Menu NETWORK DEFINITION

This menu permits to enter the network parameters for the SIM card of the operator. The default values comply with the values of the R&S test SIM card CRT-Z2.

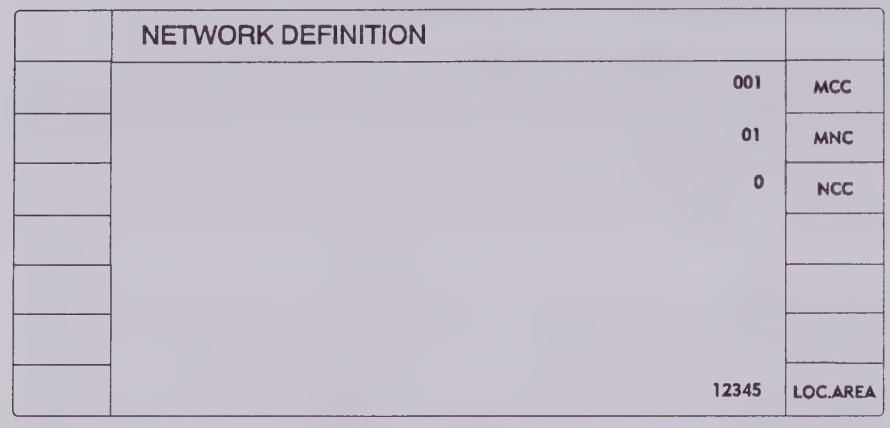


Fig. 2.4-21 NETWORK DEFINITION menu

MCC Mobile Country Code.

MNC Mobile Network Code.

NCC Network Colour Code.

LOC. AREA Location Area.

2.4.6.7 Configuration Menu BS SIGNAL DEFINITION

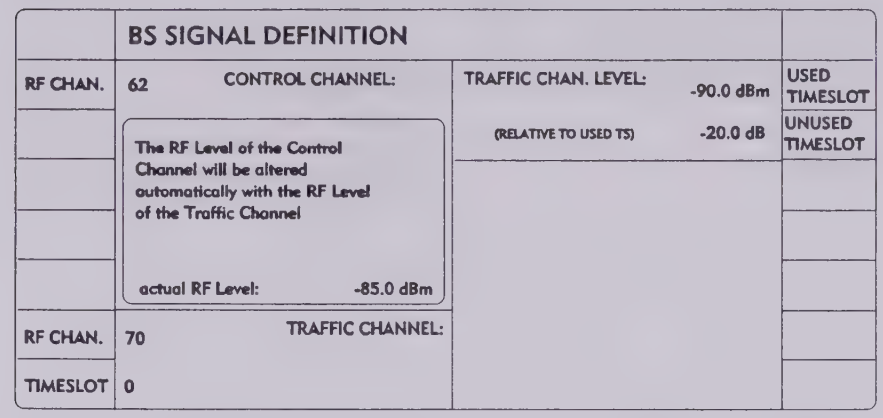


Fig. 2.4-22 BS SIGNAL DEFINITION menu

In this configuration menu, the parameters of the RF signals sent by the measuring instrument to the mobile station are determined. An RF synthesizer provides the common control channel (continuous BCCH carrier), the second one simulates the traffic channel.

RF CHAN.

This softkey permits to set the RF channel of the common control channel. The timeslot is 0 and cannot be changed. The RF level of the common control channel is automatically set with that of the traffic channel and indicated accordingly.

RF CHAN.

to

UNUSED TIMESLOT

These 4 softkeys permit to set the parameters of the traffic channel.

2.4.6.8 Configuration Menu RF CONNECTOR/EXT. ATTENUATION

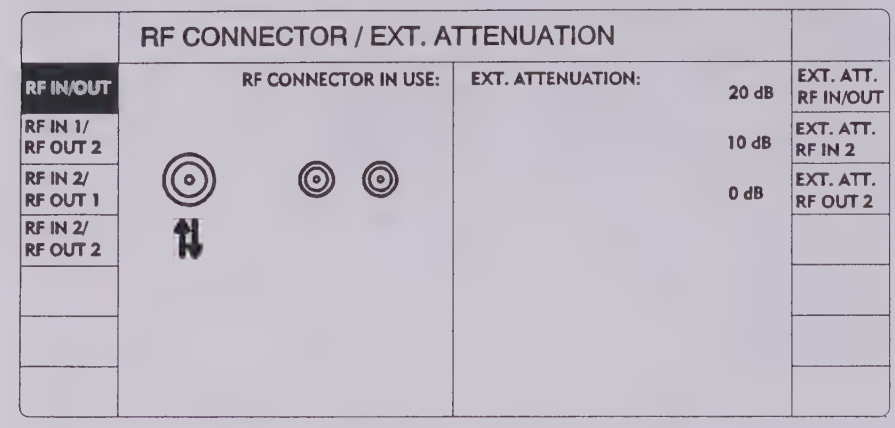


Fig. 2.4-23 RF CONNECTOR/EXT. ATTENUATION menu

The CMD is equipped with 3 RF connectors:

- A bidirectional input/output (RF IN/OUT)
- A sensitive input (RF IN2)
- A high-level output (RF OUT2)

These three connectors cannot only be used alternatively, but also in combinations. There are 4 combinations. For each of the connectors, an attenuation value can be entered on the CMD to be taken into account in the case of level settings and level measurements; negative attenuation values are gains.

RF IN/OUT

to

RF IN2/ RF OUT2

These four softkeys permit to select one of the four input/output combinations.

EXT. ATT RF IN/OUT

to

EXT. ATT. RF OUT2

These softkeys permit to inform the instrument on external attenuation values in dB to be considered with level outputs and level measurements; negative attenuation values are gains. There is only a uniform attenuation or gain for the bidirectional input/output.

2.4.6.9 Configuration Menu SYNCHRONIZATION

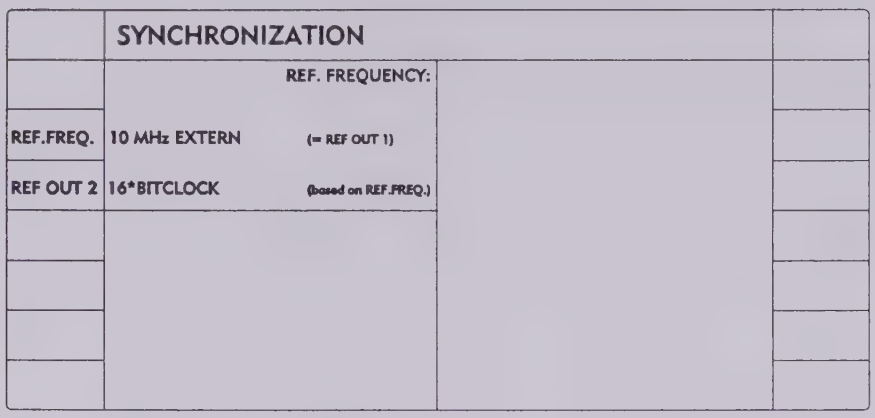


Fig. 2.4-24 SYNCHRONIZATION menu

REF. FREQ.

Selection of external synchronization with different reference frequencies at the reference frequency input or internal synchronizaton with 10 MHz (TCXO or OCXO CMD-B1). This frequency is then applied to reference frequency output 1.

REF OUT 2

Selection of the frequency for reference frequency output 2.

2.4.6.10 Configuration Menu RF SIGNAL GENERATOR

7 complete parameter sets for the RF signal generator can be configured.

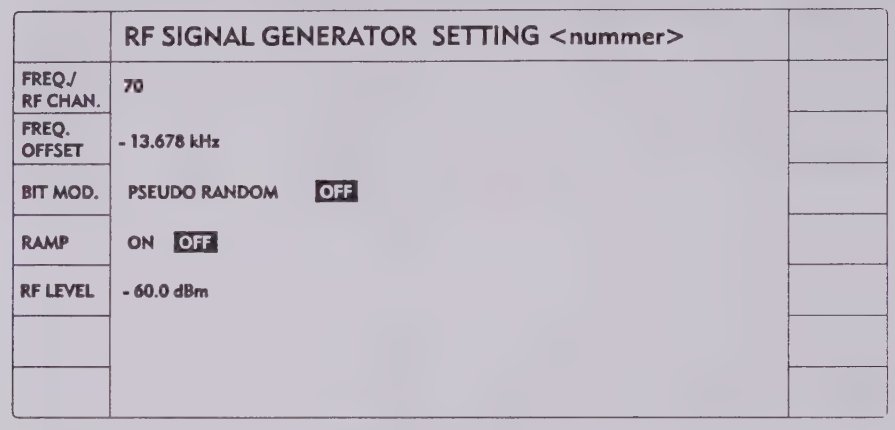


Fig. 2.4-25 RF SIGNAL GENERATOR SETTING menu

FREQ./ RF CHAN. — Input of RF frequency or RF channel.

FREQ. OFFSET — Input of frequency offset (fine frequency resolution)

BIT MOD. — Selection of operating mode modulated/unmodulated

RAMP — Selection of operating mode burst/no burst.

RF LEVEL — Input of RF output level.
Note:
For details on input see section 2.4.5.2, RF GENERATOR.

Page

3	Remote Control	3.1
3.1	Setting the Device Address	3.2
3.2	Local/Remote Switchover	3.2
3.3	Interface Messages	3.3
3.3.1	Universal Commands	3.3
3.3.2	Addressed Commands	3.3
3.4	Device Messages	3.5
3.4.1	Commands Received by the CMD in Listener Mode	3.5
3.4.2	Messages Sent by the CMD in Talker Mode	3.8
3.4.3	Device-independent Commands	3.9
3.4.4	Device-specific Commands	3.13
3.5	Service Request and Status Registers	3.14
3.6	Resetting of Device Functions	3.18
3.7	Command Processing Sequence and Synchronization	3.19
3.8	Error Handling	3.20

3 Remote Control

IEC bus or RS232 can be selected as an interface for remote control. For the IEC bus, the default address is set to 1.
The serial interface has the following default settings:

Baud rate	9600 baud
Data bits	8 bits
Stop bits	1 bit
Parity	none
Log	XON/XOFF

Note as to the remote control via RS232:
Some computers send characters on the serial interface already in booting, which causes the CMD to switch over to remote mode as soon as it receives these characters (since an explicit addressing is not possible with the serial remote control).

The IEC/IEEE bus interface corresponds to the IEC 625-1 or IEEE 488.1 standard and to IEEE 488.2 also approved of by the IEC commission. This standard describes data transfer formats and common commands etc. Further, the command syntax conforms to standard SCPI 1993.0.

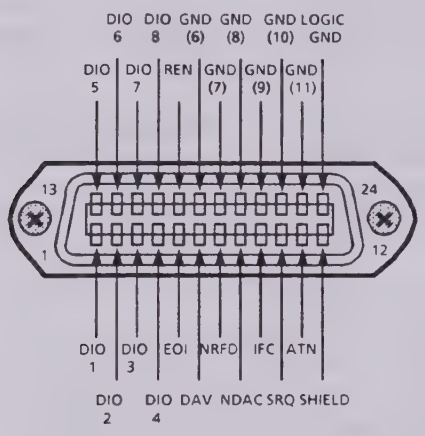


Fig. 3-1 Pin assignment

The bus connection socket is fitted to the rear of the instrument. The instrument is equipped with the 24-contact socket according to the IEEE 488 standard. The interface contains three groups of bus lines:

1. **Data bus with 8 lines DIO 1 to DIO 8**

   Data transmission is bit-parallel and byte-serial with the characters in ISO 7-bit code (ASCII code).

   DIO 1 represents the least significant bit and DIO 8 the most significant bit.

2. **Control bus with 5 lines**

   This is used to transmit control functions:

   ATN (Attention)
   becomes active Low when addresses, universal commands or addressed commands are transmitted to the connected devices.

   REN (Remote Enable)
   enables the device to be switched to the remote status.

   SRQ (Service Request)
   enables a connected device to send a Service Request to the controller by activating this line.

   IFC (Interface Clear)
   is activated by the controller in order to set the IEC interfaces of the connected devices to a defined status.

   EOI (End or Identify)
   is used to identify the end of data transfer and is used with a parallel poll.

3. **Handshake bus with 3 lines**

   Used to control the data transfer timing.

   NRFD (Not Ready For Data)
   an active Low on this line signals to the talker/controller that one of the connected devices is not ready to accept data.

   DAV (Data Valid)
   is activated by the talker/controller shortly after a new data byte has been applied to the data bus.

   NDAC (Not Data Accepted)
   is held at active Low by the connected device until it has accepted the data present on the data bus

Detailed information on the data transfer timing is available in the IEC 625-1 standard.

According to the IEC 625-1 standard, devices controlled via the IEC bus can be equipped with different interface functions. Table 3-1 lists the interface functions applicable to the instrument:

Table 3-1 Interface functions

Control characters	Interface function
SH1	Source Handshake function, complete capability
AH1	Acceptor Handshake function, complete capability
L4	Listener function,complete capability, unaddress if MTA
T6	Talker function,complete capability, capability to reply to serial poll, unaddress if MLA
SR1	Service Request function, complete capability
PP1	Parallel Poll function, complete capability
RL1	Remote/Local switchover function, complete capability
DC1	Device Cleart function, complete capability
DT0	Device Trigger function, no Device Trigger
C0	Controller function, no controller function

3.1 Setting the Device Address

The device address can be set in the CONFIG menu using the IEEE ADDRESS function. The address between 0 and 30 is entered using the numeric keys and remains stored when the device is switched off. The instrument is factory-set to address 1.

The address is the decimal equivalent of bits 1 to 5 of the Talker or Listener address. This form is also used with the IEC-bus command of the controller.

3.2 Local / Remote Switchover

The device is in the Local state (manual mode) when switched on.

If the instrument is addressed as a Listener by a controller, it enters the Remote state in line with the standard and remains in this state after data transfer has been completed. All controls on the front panel except the LOCAL key are disabled.

There are two methods to return to the "Local" state:

- by the addressed command GTL (Go to Local) from the controller.
- by pressing the LOCAL key. Data output from the controller to the instrument should be stopped before pressing the LOCAL key for otherwise the instrument will immediately enter the Remote state again. The function of the LOCAL key can be disabled by the controller by sending the universal command LLO (Local Lockout).

The other device settings are not changed when switching from Remote to Local state or vice versa.

When the CMD is switched to the Local state, the respective main menu of the current operating mode is indicated.

3.3 Interface Messages

Interface messages (according to IEC 625-1/IEEE 488 standard) are transmitted to the device on the data lines where the Attention line ATN is active (low).

3.3.1 Universal Commands

The universal commands have codes between 10 and 1F hexadecimal (see Table 3-4). They act, without previous addressing, on all devices connected to the bus.

Table 3-2 Universal commands

Command	Basic command with R&S controllers	Function
DCL (Device Clear)	IECDCL	Aborts processing of the currently received commands and sets the command processing software to a defined initial status. The device setting is not changed.
LLO (Local Lockout)	IECLLO	The STOP key is disabled.
SPE (Serial Poll Enable)	IECSPE *	Ready for serial poll.
SPD (Serial Poll Disable)	IECSPD *	End of serial poll.

* The BASIC command "IECSPL adr, status" contains the commands "IECSPE" and "IECSPD" and additionally reads the status of the device with address "adr" and stores this in the integer variable "status".

3.3.2 Addressed Commands

The addressed commands have codes between 00 and 0F hexadecimal (see Table 3-4). They only act on devices addressed as Listeners (by the BASIC command "IECLAD addr").

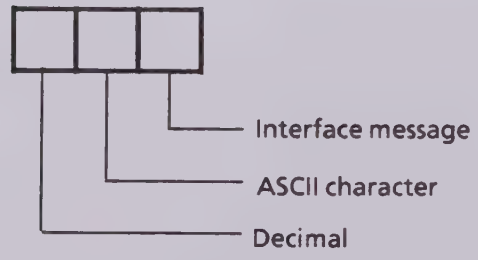
Table 3-3 Addressed commands

Command	Basic command with R&S controllers	Function
SDC (Selected Device Clear)	IECSDC	Aborts processing of the currently received commands and sets the command processing software to a defined initial status. The device setting is not changed.
GTL (Go To Local)	IECGTL	Change to Local state (manual operation)

Table 3-4 ASCII/ISO and IEC-character set

Control characters						Numbers and special characters				Upper-case letters				Lower-case letters			
0	NUL		16	DLE		32	SP	48	0	64	@	80	P	96	`	112	p
1	SOH	GTL	17	DC1	LLO	33	!	49	1	65	A	81	Q	97	a	113	q
2	STX		18	DC2		34	"	50	2	66	B	82	R	98	b	114	r
3	ETX		19	DC3		35	#	51	3	67	C	83	S	99	c	115	s
4	EOT	SDC	20	DC4	DCL	36	$	52	4	68	D	84	T	100	d	116	t
5	ENQ	PPC	21	NAK	PPU	37	%	53	5	69	E	85	U	101	e	117	u
6	ACK		22	SYN		38	&	54	6	70	F	86	V	102	f	118	v
7	BEL		23	ETB		39	´	55	7	71	G	87	W	103	g	119	w
8	BS	GET	24	CAN	SPE	40	(	56	8	72	H	88	X	104	h	120	x
9	HT	TCT	25	EM	SPD	41	)	57	9	73	I	89	Y	105	i	121	y
10	LF		26	SUB		42	*	58	:	74	J	90	Z	106	j	122	z
11	VT		27	ESC		43	+	59	;	75	K	91	[	107	k	123	{
12	FF		28	FS		44	,	60	<	76	L	92	\	108	l	124	|
13	CR		29	GS		45	-	61	=	77	M	93	]	109	m	125	}
14	SO		30	RS		46	.	62	>	78	N	94	^	110	n	126	~
15	SI		31	US		47	/	63	? / UNL	79	O	95	-	111	o	127	DEL
Addressed commands			Universal commands			Listener addresses				Talker addresses				Secondary addresses and commands			

Code:



3.4 Device Messages

Device messages (in line with IEC 625-1) are transmitted on the data lines, in which case the Attention line is High, i.e. not active. The ASCII code (ISO 7-bit code) is used (see Table 3-4).

As can be seen in Table 3-5, the device messages can be grouped according to two different aspects.

Table 3-5 Grouping of device messages

Type of commands	Direction of transfer	
	Messages received by the CMD	Messages sent by the CMD
Common device-independent commands (in line with the IEEE 488.2/SCPI 1993.0 standard)	cf. Table 3-6	cf. Table 3-7
Device-specific commands (dependent on the device characteristics)	see annex	see annex

In the following text, device messages received by the CMD are referred to as commands.

Commands with a "?", such as "CONF:CHAN?" request the CMD to output a measured value . For the given example, this is:

"CONF:CHAN -50",

when always the basic unit applies (dBm in this case) if no unit is indicated.

3.4.1 Commands Received by the CMD in Listener Mode (Controller to Device Messages)

Input buffer:

All commands received are buffered in a memory of max. 256 bytes; it is also possible to process command lines which are longer. In this case, the part of the command line which was first received is already processed in the device.

Command syntax:

Fig. 3-2 shows the syntax of a command line (program message). Every command line must end with a terminator.

Terminators:

- New line (ASCII code 10 decimal)
- End (EOI line active) together with the last useful character of the command line or the new line character.

Since the carriage return character (ASCII code 13 decimal) is permissible as a filler without effect before the terminator, the combination of carriage return + new line is permissible.

All IEC-bus controllers from Rohde & Schwarz send terminators accepted by the device as standard. A command line may require more than one line on the controller screen since it is only limited by the terminator. The terminator is automatically added to the end of command text with most IEC-bus controllers.

Separators:

A command line may contain several commands (program message units) separated by semicolons (;).

Command structure:

A command may consist of the following parts:

- Only a header
  Example: **RST*

- Header and question mark
  (Query)
  Example: *CONF:CHAN?*

This combination requests the CMD to transfer the desired data to an output buffer in order to transfer them via the IEC bus as soon as it is addressed as a Talker (see Section 3.4.2).

- Header and number

  Examples: *CONF:CHAN -50*
  CONF:CHAN -50 dBm

To remain in accordance with the IEEE 488.2 standard, the header and number(s) must be separated by at least one space (ASCII code 32 decimal). In the case of device-specific commands, the number can be supplemented by a unit.

- Header and string

  Example: *CONF:CHAN MAX*

The headers and their meanings are explained in Sections 3.4.3 and 3.4.4.

Lower case/upper case letters:

Lower case letters are permissible and are equivalent to the corresponding upper case letters. Thus units can be used in the usual form (e.g.: dBm) instead of the notation using upper case letters which is also permissible (e.g. DBM).

Spaces:

Additional spaces may be inserted at the following points:

- before a header;
- between header and number;
- before and after commas (,) and semicolons (;)
- before the terminator.

Decimal numbers:

The following notations are permissible for decimal numbers:

- With and without sign
  e. g. *5, +5, -5*

- With and without decimal point, any position of decimal point is permissible.
  e. g. *1.234, -100.5, .327*

- With or without exponent to base 10, "E" or "e" is used as the exponent character.

  e. g. *.451, 451E-3, +4.51e-2*

- The exponent is permissible with or without a sign, also a space is permissible instead of the sign.
  e. g. *1.5E+3, 1.5E-3, 1.5E 3*

- Leading zeros are permissible in the mantissa and exponent.
  e. g. *+0001.5, -01.5E-03*

- The length of the number, including the exponent, may be up to 30 characters. The number of digits for the mantissa and exponent is only limited by this condition. Digits which exceed the resolution of the device are rounded up or down; they are always considered for the order of magnitude (power of ten).
  e. g. *150000000, 0.00000032*

If two numeric entries are permissible with one command, they are separated by comma, e.g. DISPLAY: MENU 2,0

Note: Specification of the exponent alone (e.g.: E-3) is not permissible, 1E-3 is correct).

Hexadecimal and binary numbers:

Hexadecimal numbers and binary numbers are permissible only without exponent and unit, the following notations are permissible:

Hexadecimal number
e.g. #H12ffab, #h12FFAB, #HFf19a

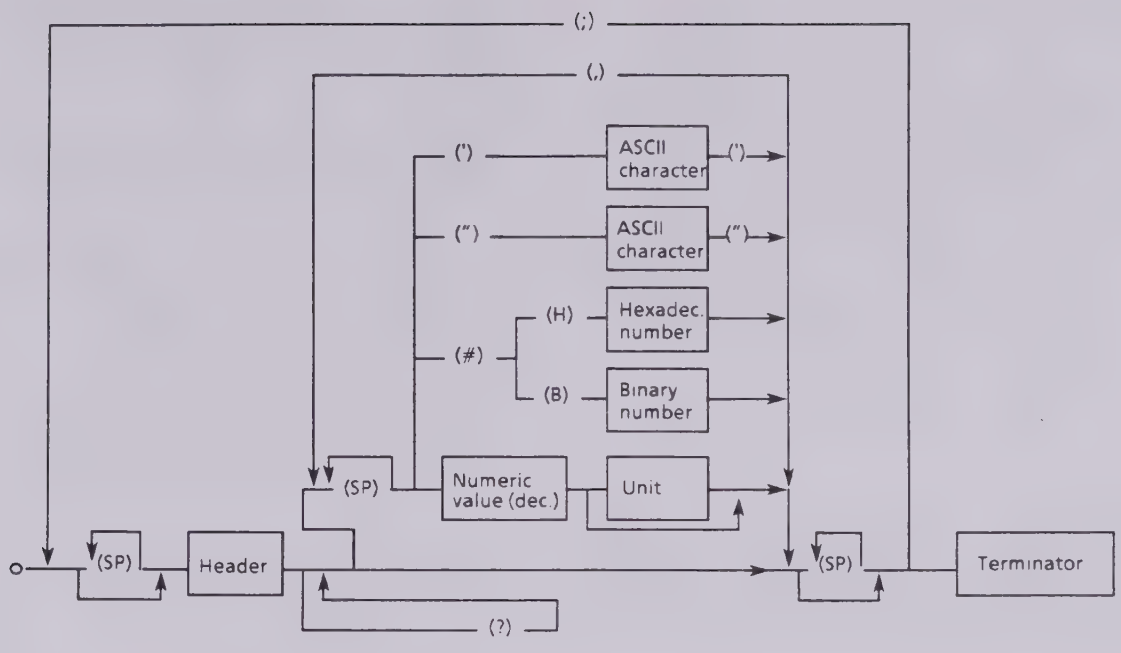
Binary number
e.g. #b101011, #B11001

String entries:

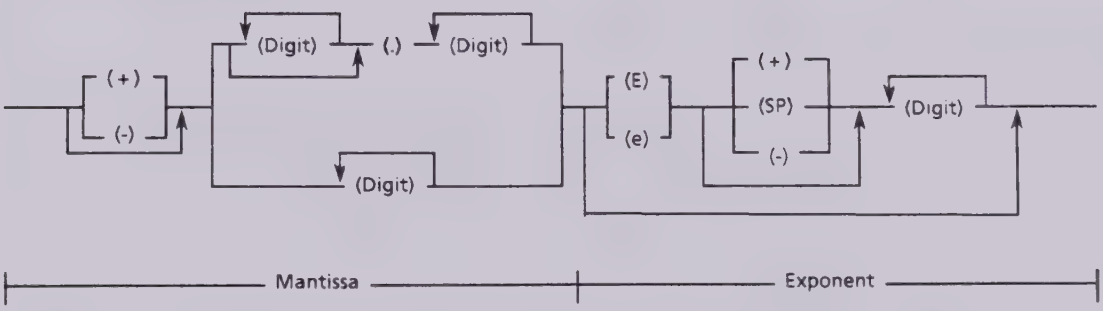
The following notations are permissible for string entries:

e.g. CODE '01234567890abcdef'
CODE '0123456789abCDEF'
CODE "01234567890abcdef"
CODE "0123456789AbcdEF"

Command line



Numeric value (decimal)



SP: Any character with ASCII code 0 to 9 and 11 to 32 decimal, especially space.

Fig. 3-2 Syntax diagram of a command line

3.4.2 Messages Sent by the CMD in Talker Mode (Device to Controller Messages)

The CMD sends messages via the IEC bus if it

- has been requested to provide data in its output buffer by one or more query messages with a question mark within one command line,
- indicates by setting bit 4 (message available) in the status byte that the requested data are now present in the output buffer (see also Section 3.5) or indicates messages in the error queue by setting bit 2
  and
- has been addressed as a talker

Note that the command line with the data request must be transmitted directly before the talker is addressed. If another command line is present in between, the output buffer is cleared.

A query message is formed by adding a question mark "?" onto the header , e.g. "CONF: CHAN?".

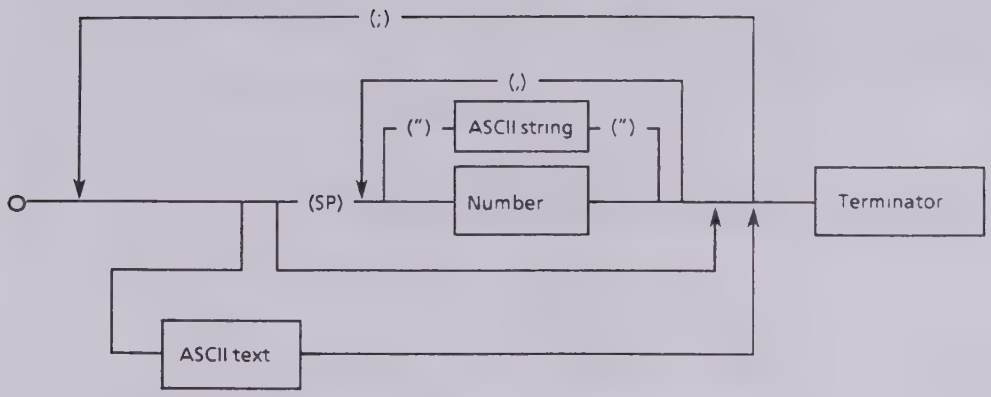
If the CMD is addressed as a Talker directly after the query message, the bus handshake is disabled until the requested data are available. This simple synchronization procedure is certainly meaningful with the CMD if the execution of a query message can take place independent of the execution and termination of a test run.

The syntax of the messages sent by the CMD is shown in Fig. 3-3. The syntax is similar to that for commands received by the CMD.

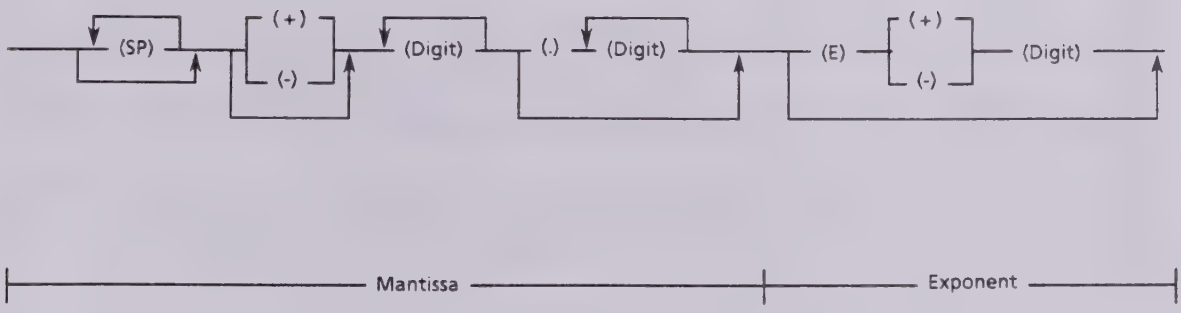
A Carriage Return/New line (ASCII code 13 and 10 decimal) together with end (line EOI active) is used as terminator.

- If the CMD receives several query messages, it also returns several messages within one line separated by semicolons (;).
- Several numbers can be sent as a reply to certain query messages, they are separated by commas (,).
- The syntax of the numbers is described in Fig. 3-3. The exact form of the numbers of each message is described in Table 3-7.
- Messages sent by the CMD do not contain units. In the case of physical variables, the numbers are referred to the basic unit of the units (V, A, W, OHM, S, Hz, RAD, PCT, DB).

Output message line



Number



SP: Space (ASCII code 32 decimal)
ASCII text: Reply to command *IDN? (see table 3-7)

Fig. 3-3 Syntax diagram of messages sent by the CMD

3.4.3 Device-independent Commands (Common Commands)

These commands are listed in Tables 3-6 and 3-7 and can be split up into the following groups:

- Commands which refer to the Service Request function with the associated status and mask registers
- Commands for device identification
- Commands which refer to the Parallel Poll function
- Commands for device-internal sequences (reset, calibrate) and for synchronizing sequences.

These are taken from the IEEE 488.2 standard, which ensures that these commands have the same effect in different devices.

The headers of these commands consist of a star (*) followed by three letters.

Table 3-6 Device-independent commands (common commands) received by the CMD

Command	Number, range	Meaning
*RST	---	**Reset** Acts on the instrument setting like the RESET key. This command does not change the status of the IEC-bus interface, the set IEC-bus address, the mask register of the Service Request function and the output buffer. A current Service Request is only reset if it has not been produced by a message in the output buffer.
*PSC	-32767... +32767	**Power On Status Clear** (reset on power-up) If ≠0: with power-up, the Service Request Enable mask register (SRE) and the Event Status Enable mask register (ESE) are cleared in addition. If 0: the above-mentioned registers retain their contents when the device is switched on and off. This enables a Service Request when the device is switched on.
*OPC	---	**Operation Complete** (ready signal) Sets bit 0 (Operation Complete) in the ESR, if all previous commands have been processed (see Section 3.7).
*CLS	---	**Clear Status** • Sets the status registers (ESR and STB) to zero. The mask registers of the Service Request function (ESE and SRE) are not changed. • Clears the output buffer. A present Service Request is cleared (see Section 3.5).
*ESE	0 to 255	**Event Status Enable** The ESE mask register is set to the specified value which is interpreted as a decimal number (see Section 3.5).
*SRE	0 to 255	**Service Request Enable** The SRE mask register is set to the specified value which is interpreted as a decimal number (see Section 3.5).

Command	Number, range	Meaning
*PRE	0 to 255	**Parallel Poll Enable** The Parallel Poll Enable mask register is set to the specified value which is interpreted as a decimal number (see Section 3.5).
*WAI	---	**Wait To Continue** Only process the subsequent commands when all previous commands have been completely executed (see Section 3.7).

Table 3-7 Device-independent commands sent by the CMD

Command	Output message Data value		Meaning
	No. of digits	Range	
*IDN?	35	alphanume-ric	**Identification Query** The following identification text is sent via the IEC/IEEE bus as a reply to the IDN? command. Example: Rohde&Schwarz, CMD,0,X.XX YY.YY.YY Rohde&Schwarz = manufacturer CMD = model 0 = reserved for serial number, (not used with CMD) X.XX = firmware version (e.g. V1.00) YY.YY.YY = date (e. g. 18.10.93)
*PSC?	1	0 or 1	**Power On Status Clear Query** To read the status of the Power On Clear Flags, see *PSC in Table 3-6
*OPC?	1	1	**Operation Complete Query** (ready message) The message "*OPC 1" is entered into the output buffer and bit 4 (message available) set in the status byte if all previous commands have been completely executed. Bit 0 (operation complete) is also set in the ESR (see Section 3.7).
*ESR?	1 to 3	0 to 255	**Event Status Register Query** The contents of the ESR are output in decimal form and the register then set to zero.

Command	Output message Data value		Meaning
	No. of digits	Range	
*ESE?	1 to 3	0 to 255	**Event Status Enable Query** The contents of the ESE mask register are output in decimal form.
*STB?	1 to 3	0 to 255	**Status Byte Query** The contents of the status byte are output in decimal form.
*SRE?	1 to 3	0 to 255	**Service Request Enable Query** The contents of the SRE mask register are output in decimal form.
*TST?	1 to 3	0 to 255	**Self-Test Query** The output value "0" indicates the duly completion of the self-test.
*IST?	1	0 or 1	For reading the actual instrument status (see section 3.5)
*PRE?	1 to 3	0 to 255	The contents of the Parallel Poll Enable register are output in decimal form.

STATUS-Subsystem and SYSTEM-Subsystem
see annex 6.2 and 6.3.

3.4.4 Device-specific Commands
(see also annex)

All CMD functions which can be set using the keyboard can also be controlled via the IEC bus. The effect of the setting commands is the same as the corresponding entry via the keyboard.

According to the output in the display, the values of all setting parameters can also be read out via the IEC bus, especially the marker frequency and marker level valu

The headers are designed in conformance with SCPI.

The headers can be abbreviated to the form indicated in upper-case letters. However, only this abbreviation or the long version is permissible (e. g. CONFIG is impermissible, CONF or CONFIGURE is correct).

Many headers consist of several parts separated by colons (:). The abbreviations can be used in each part of the header (e.g. CONF:CHAN instead of CONFIGURE:CHANNEL).

Certain commands may have a character string as the data, e.g. CONF:CHAN MAX.

A unit can be added directly to the numbers in the setting commands. They may be written with lower-case or upper-case letters. If no unit is used, the respective default unit applies (V, A , OHM, S, HZ, RAD, PCT, DB).

3.5 Service Request and Status Registers

The following Fig. shows the status registers and the effective links between them. To remain in accordance with the IEEE 488.2/SCPI 1993.0 standard, the Status Byte (STB) and its associated mask register (SRE), which are also present with older devices, have been supplemented by the Event Status Register (ESR) and its Event Status Enable Mask Register (ESE).

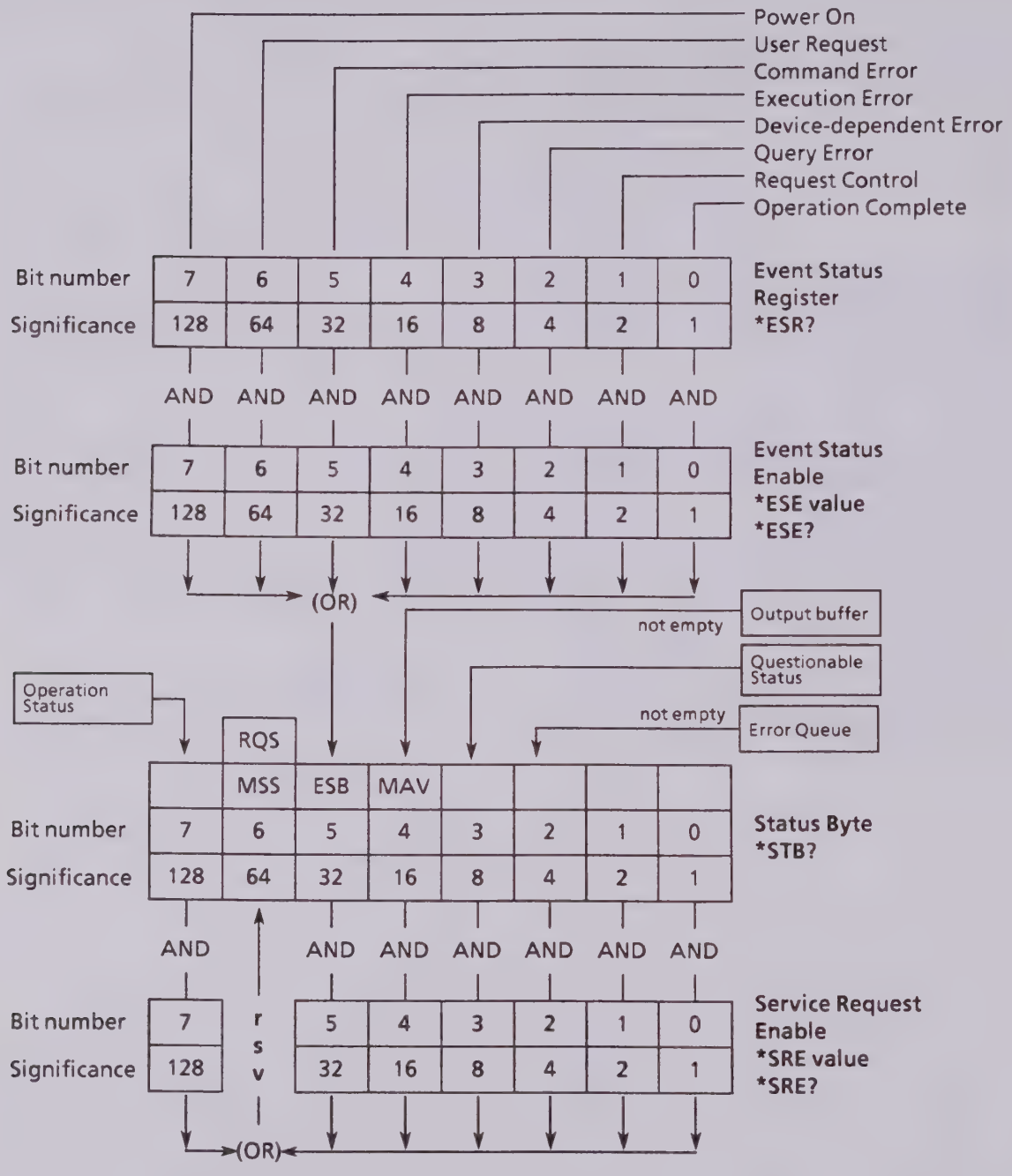


Fig. 3-4 Status registers

A bit is set to "1" in the ESR in the case of certain events (e.g. fault, ready signal), see Table 3-9. These bits remain set until they are cleared by reading the ESR (by the command *ESR?) or by the following conditions:

- The commands *RST or *CLS
- Switching on the AC supply (the power-on bit is, however, set in this case).

Using the ESE mask register, the user can select the bits in the ESR which also set the sum bit ESB (bit 5 in the status byte) via which a service request can be triggered. The sum bit is therefore only set if at least one bit in the ESR and the corresponding bits in the ESE are set to "1". The sum bit is automatically cleared again if the previous condition is no longer fulfilled, e.g. if the bits in the ESR have been cleared by reading the ESR or if the ESE has been modified.

The ESE mask register is written by the command "*ESE value" ("value" is the contents in decimal form) and can be read again by the command *ESE?. It is set to "0" when the AC power is switched on if the power on status clear flag is "1" (*PSC1).The ESE mask register is not changed by other commands or interface messages (DCL, SDC).

The bits listed in Table 3-8 are used in the status byte (STB):

Table 3-8 Bit allocation of status byte

Bit number	Bus line	Designation	Meaning
2	DIO 3	---	There is an entry in the error queue
3	DIO 4	---	Sum bit of the Questionable status
4	DIO 5	MAV	Message Available Indicates that a message, which can be read, is present in the output buffer. The bit is "0" if the output buffer is empty.
5	DIO 6	ESB	Sum bit of the Event Status Register
6	DIO 7	RQS	Request Service
7	DIO 8	---	Sum bit of the Operation status

Note that the status register bits are numbered from 0 to 7 in compliance with the standard, but the bus data lines are designated DIO1 to DIO8.

Table 3-9 Bit allocation of ESR

Bit Number	Meaning
7	**Power On** Is set when the instrument is switched on or if the power returns following a failure.
6	**User Request** This function is not implemented in the CMD.
5	**Command Error** Is set if one of the following faults is detected in the received commands: • Syntax error • Illegal unit • Illegal header • A number has been combined with a header where no number is allowed.
4	**Execution Error** Is set if one of the following errors was detected during execution of the received commands • A number is outside the permissible range (for the respective parameter). • A received command is not compatible with the current device setting.
3	**Device-dependent Error** Is set if functional errors occur.
2	**Query Error** This bit is set: • If the controller wishes to read data from the CMD but no query message has previously been output. • If the data present in the output buffer of the CMD have not been read out and a new command was sent to the instrument instead. The output buffer is cleard in this case.
1	**Request Control** This function is not implemented in the CMD.
0	**Operation Complete** This bit is set by the commands *OPC and *OPC? if all previous commands have been executed.

Using the SRE mask register, the user can determine whether the RQS bit of the status byte is set and a service request sent to the controller by activating the SRQ line with a set bit of the status byte. Since each bit in the SRE mask register is assigned to the corresponding bit in the status byte, the following possibilities result (see Table 3-10), and the combinations thereof.

Table 3-10 Bit allocation of the SRE

Contents of SRE (decimal)	Set bit No. in SRE	Effect
0	--	No Service Request
4	2	Service Request if there is a message in the error queue
8	3	Service Request if bit (s) is/are set in the Questionable status (and not marked)
16	4	Service Request if MAV bit is set (message in output buffer)
32	5	Service Request if ESB bit is set (at least 1 bit set and not masked in the ESR)
128	7	Service Request if bit (s) is/are set in the Operation status (and not marked)

The Service Request Enable mask register (SRE) is written by the command "*SRE value" ("value" is the contents in decimal form) and can be read again by the command *SRE?. It is set to "0" when the AC power is switched on, if the power-on clear flag is "1"; the Service Request function of the CMD is thus disabled. The SRE mask register is not changed by other commands or interface messages (DCL, SDC).

Several devices can trigger a Service Request simultaneously, the open collector drivers generate an OR function on the SRQ line. The controller must read the status bytes of the devices in order to identify the device which has triggered the Service Request. A set RQS bit (bit 6/DIO7) indicates that the device is sending a Service Request.

The status byte of the CMD can be read in the following manner:

- By the command *STB?.

  The contents are then output in decimal form. The status byte is not changed by reading out, and the Service Request is not cleared.

- By a Serial Poll.

  The contents are transferred in binary form as one byte. The RQS bit is then set to "0" and the Service Request becomes inactive; the other bits of the status byte are not changed.

The status byte is cleared:

- By the command *CLS.

  This command clears the ESR and the output buffer; the ESB and MAV bits in the status byte are also set to "0". This in turn clears the RQS bit and the Service Request.

- By reading the ESR (*ESR? command) or setting the ESE mask register to "0" (*ESE command) and by reading the contents of the output buffer.

- By reading out the error queue using SYSTEM:ERROR?

- By reading the Questionable/Operation status register or zeroing the respective enable register.

3.6 Resetting of Device Functions

The following table lists the various commands and events which cause individual device functions to be reset.

Table 3-11 Resetting of various device functions

Event	Power on		DCL, SDC (Device Clear, Selected Device Clear)	Commands	
	Power-on-clear flag			*RST	*CLS
	0	1			
Basic device setting	--	--	--	Yes	--
Set Event Status Register ESR to zero	Yes	Yes	--	Yes	Yes
Set mask registers ESE and SRE to zero	--	Yes	--	--	--
Clear output buffer	Yes	Yes	Yes	--	Yes
Clear Service Request	Yes	1)	2)	3)	Yes
Reset command processing and input buffer	Yes	Yes	Yes	--	--

1) Yes, but "Service Request on power on" is possible.
2) Yes, if only caused by message in output buffer.
3) Yes, if not caused by message in output buffer.

3.7 Command Processing Sequence and Synchronization

The commands received by the CMD are first stored in an input buffer and are processed in the order in which they were sent. During this time, the IEC bus can be used for communication with other devices. Command lines which exceed the capacity of the input buffer are processed in several sections. The bus is occupied during this time.

OPERATION COMPLETE:

The commands *OPC and *OPC? (operation complete) are used as feedbacks to inform on the time at which processing of the received commands was terminated and a measurement (if any) has been completely performed.

*OPC sets bit 0 in the ESR, and a Service Request can then be triggered if all previous commands have been executed.

*OPC? additionally provides a message in the output buffer and sets bit 4 (MAV) in the status byte.

WAIT:

The synchronization can be established within a command line by the command "*WAI", i.e. all subsequent commands are only executed when the previous commands have been completely executed. This may be favourable in the case of very short measuring times.

Program example:

A program example of a channel setting is given in the following, where a Service Request is triggered in the case of error. The type of error generated is specified in detail.

(The command set of the IEC-bus controllers PCA is used; the IEC bus address of the CMD has been taken as 1.)

```
10 IEC TERM 10                                          : REM input terminator LF
20 ON SRQ1 GOSUB 300
30 IEC OUT 1, "*CLS; *ESE 60; *SRE 32"
40 REM
50 REM                                                  for Service Request in case
60 REM                                                  of error
110 IEC OUT 1, "CONF : CHAN:ARFC?"                      : REM counting of RF
120 IEC IN 1, CHANNEL$
130 PRINT CHANNEL$
140 END
300 REM ------------------------------------------------
310 REM              SERVICE REQUEST ROUTINE
320 REM ------------------------------------------------
330 IEC SPL 1,S%                                        : REM Serial Poll
340 IF (S% AND 64) = 0 THEN GOTO 420                    : REM SRQ not from CMD?
350 IEC OUT 1, "*ESR?"                                  : REM  Event Status Register
360 IEC IN 1, X$                                        : REM read
370 B = VAL (X$)
380 IF (B AND 032) <>0 THEN PRINT "COMMAND ERROR"
390 IF (B AND 016) <>0 THEN PRINT "EXECUTION ERROR"
400 IF (B AND 008) <>0 THEN PRINT "DEVICE DEPENDENT ERROR"
410 IF (B AND 004) <>0 THEN PRINT "QUERY ERROR"
420 ON SRQ1 GOSUB 300
430 RETURN
500 REM ------------------------------------------------
510 REM     SERVICE REQUEST FROM OTHER DEVICE
520 REM ------------------------------------------------
530 REM....
540 REM....
620 ON SRQ1 GOSUB 300
630 RETURN
```

3.8 Error Handling

All errors detected by the CMD in connection with operation via the IEC bus are indicated in the ESR by setting a bit (bit 2, 4 or 5, see Table 3-9). Function faults are signalled by setting of bit 3. At the same time, a message is entered into the error queue. These bits remain set until the ESR is read or is cleared by the commands *RST or *CLS. This is in line with the standard IEEE 488.2/SCPI 1993.0 and enables triggering of a Service Request and program-controlled evaluation of the type of error.

Annex

to

Remote Control

Contents

1. General Information

1.1. DCS1800 6
1.2. States 6
1.3. Note 7
1.4. Error Recovery 7

2. Settings 8

2.1. Input and Output 8
External attenuation at RF In Out 8
External attenuation at RF In 2 8
External attenuation at RF Out 2 8
2.2. Inputs and Outputs Used 8
2.3. Reference Frequency
2.4. Signalling and RF Parameters 9
2.4.1. Signalling Parameters for Mobile Station
International Mobile Subscriber Identity (IMSI) 9
International Mobile Equipment Identity (IMEI) 9
Receiving level at the mobile station (RXLEV) 9
Receiving quality at the mobile station (RXQUAL) 9
Number selected 9
Power class 9
Mobile power signalled 9
Measured power of the mobile (peak value) 10
2.4.2. Signalling Parameters for CMD 10
Mobile Country Code 10
Mobile Network Code 10
Network Colour Code 10
Location Area Code 10
Channel number (ARFCN) 10
Timeslot of TCH 10
Transmitter power of the TCH in the used timeslot
Transmitter power of the THD in the unused timeslots 11
2.5. Burst Analysis 11
Channel number (ARFCN) 11
Training Sequence Codes 11
Expected power (of mobile station) 11
2.6. Network and Test Mode 12
Network 12
Test mode 12

3. Call Setup and Release 13

Call setup from the CMD to the mobile (Call) 13
Call release from the CMD to the mobile (Release) 13
Change of channel for TCH 13
Change of timeslot for TCH 13
Power change (mobile station, only used timeslot) 13
Power change (CMD) in the used timeslot 13
Power change (CMD) in the unused timeslots 13

4. RF Generator 14

4.1. Configuration of a Generator Parameter Set 14
Selection of generator configuration 14
Frequency 14
Frequency offset 14
Type of modulation 14
Ramping mode 14
Output level 14
4.2. Setting of the Current Generator Parameter Set 15
Setting a generator configuration 15
Frequency 15
Frequency offset 15
Type of modulation 15
Ramping mode 15
Output level 15

5. AF Generator Setting 17

Frequency 17
Level 17
Switching the generator on and off 17

6. AF setting 17

Distortion frequency 17
Lower limit frequency (for distortion and voltmeter) 17

7. Measurement, Analysis and Result Query 18

7.1. AF Measurement 18
Display format of AF counter 18
Display format of voltmeter 18
AF counter 18
AF voltage 18
Distortion 18
7.2. BER 19
7.2.1. Selection of the BER Measurement Configuration (Parameter Set) 19
7.2.2. Measurement Tolerances for the BER Measurement Configuration Selected 19
Maximal values for class-Ib events 19
Maximal values for class-II events 19
Maximal values for erased frames 19
7.2.3. Measurement Parameters for the BER Measurement Configuration Selected 19
Level for TCH in the used timeslot 19
Level for TCH in the unused timeslots 19
Number of frames to be sent 19
Maximal number of the samples to be sent and test time 20
Abort condition for BER measurement 20
7.2.4. Measurement 20
Measured values of class Ib 20
Measured values of class II 20
Measured values of the erased frames 21
Total result of a BER measurement 21
7.3. Power 22
7.3.1. Tolerance Values 22
Resetting to default values 22
Tolerance limits for average power in the power time template 22
Tolerance limits for power time template 22

Query for the observance of the tolerance limits for average power 23
Query for the observance of the tolerance limits of the power/time template 23
7.3.2. Power Measurement 23
Average power of the burst 23
Power values of the entire burst 23
7.4. Phase and Frequency Error 24
7.4.1. Tolerance Limits 24
Resetting to default values 24
Tolerance limits for phase and frequency error 24
Query for the observance of the tolerance limits 24
7.4.2. Phase Error Measurement 24
Total phase error of a burst 24
Phase error values of the entire burst 24
7.4.3. Frequency Error Measurement 25
Total frequency error of a burst 25
7.5. Other Measurements 26
Current measurement 26
Voltage measurement 26

8. Miscellaneous 28

8.1. Internal Instrument State 28
Current instrument state 28
8.2. Signalling Asynchronous Events 28
CMD Event Register 28
CMD Operation Condition Register 28
CMD Event Register Enable 28
8.3. Query of Options 29
8.4. Remote Control 29
Screen display of remote-control commands and responses 29
IEC-bus address 29

9. Specified Commands 30

9.1. Mandatory Commands 30
Clear Status 30
Standard Event Status Enable 30
Standard Event Status Register 30
Identification Query 30
Individual Status Query 30
Operation Complete 30
Parallel Poll Enable Register Enable 30
Power-on Status Clear 31
Reset 31
Service Request Enable 31
Status Byte Query 31
Self-Test 31
Wait-to-Continue 31
9.2. Optional Commands 31
Query of options 31
9.3. STATus Subsystem 32
Operation Event Register 32
Operation Condition Register 32
Operation Event Register Enable 32
Questionable Event Register 32
Questionable Condition Register 32
Questionable Event Register Enable 32
Reset 32

Status Queue 32
9.4. SYSTem Subsystem 33
Next message from error queue 33
SCPI Version 33

10. Summary of All Commands 34

1. General Information

1.1. DCS1800

The settings for DCS1800 are only provided for the CMD55; the CMD52 outputs an error message when the attempt is made to set DCS1800 values.

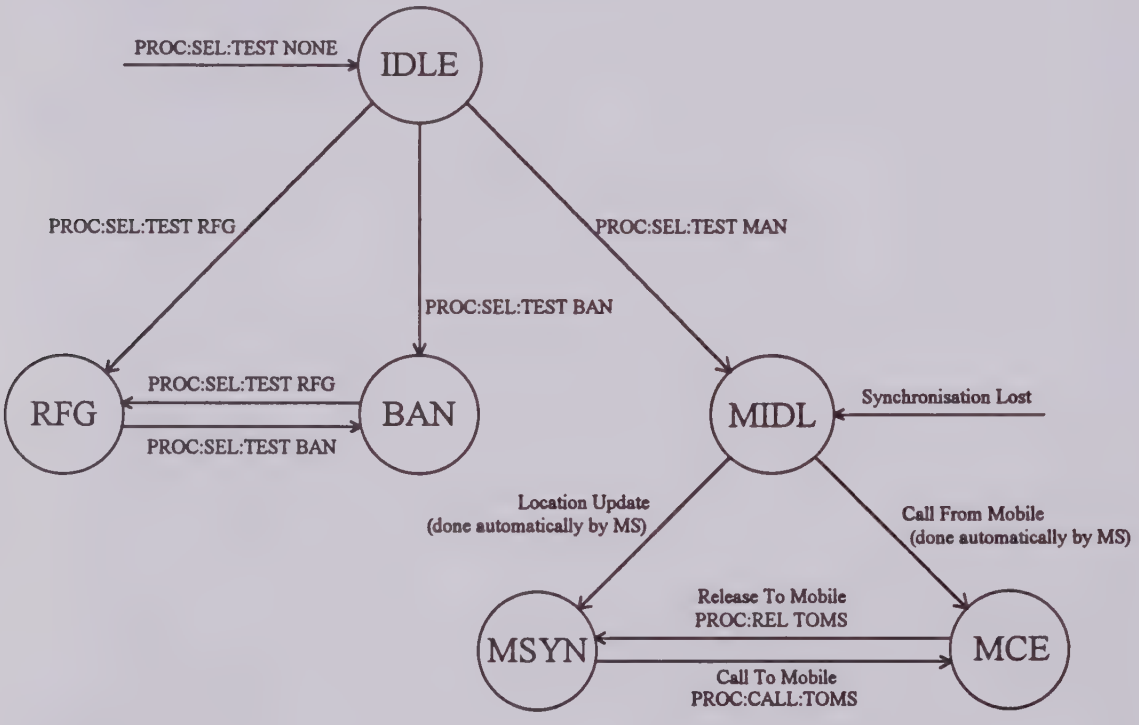
If DCS1800 is desired as type of network, the switchover must be made by means of CONFigure:NETWork:TYPE DCS1800 before settings are changed. After the switchover, all commands use the DCS1800 data set, without switchover the GSM data set is used.

1.2. States

The following abbreviations are used to indicate the permissible states in the description of the commands:

IDLE:	Initial state of the CMD; is also achieved by means of PROCedure:SELect[:TEST] NONE.
BAN:	Burst analysis active
MIDL:	MS test selected
MSYN:	MS test: Synchronized (call setup possible; BCCH is generated)
MCE:	MS-Test: Call Established
RFG:	RF generator active
ALL:	All states (IDLE, BAN, MIDL, MSYN, MCE or RFG)

The following diagram explains the individual transistions of states:



1.3. Note

<numeric_value> denotes a numeric value; MAXimum or MINimum can be indicated as well unless stated otherwise.
If <numeric_value> may contain a unit, indicating the unit is optional. The value is always returned without a unit.

<value> denotes a character date from a list; only list entries are permissible.

All commands are structured analogously to the SCPI description i.e. the upper-case letters indicate the short form of the command; the CMD only accepts this short form as an abbreviation (according to SCPI), otherwise the long form is to be used.

1.4. Error Recovery

If no value is existing with queries or the value is invalid, NAN is returned instead of the value. An overflow of the value is indicated by means of INF, a missing input signal by means of NINF.

If the CMD is not in the right state to be able to carry out the command, SCPI error 221, "Settings conflict", is generated. No value is returned in the case of queries.
The permisible state is stated in the following table in column "state".

If, however, an option to execute the command is missing, SCPI error 241, "Hardware missing" is displayed. No result is returned either in the case of a query.
The option necessary to execute the command is entered in the tables under "option".

2. Settings

2.1. Input and Output

External attenuation at RF In Out

Syntax:	SENSe1:CORRection:LOSS[:INPut][:MAGNitude] <numeric_value> or SOURce1:CORRection:LOSS[:OUTPut][:MAGNitude] <numeric_value>			
Value range:	-40.0 ... +50.0 dB			Default: 0.0 dB
State: IDLE	Option: none	with Query	Note: Positive values refer to an attenuation, (N2a)	

External attenuation at RF In 2

Syntax:	SENSe2:CORRection:LOSS[:INPut][:MAGNitude] <numeric_value>			
Value range:	-40.0 ... +90.0 dB			Default: 0.0 dB
State: IDLE	Option: none	with Query	Note: Positive values refer to an attenuation, (N2a)	

External attenuation at RF Out 2

Syntax:	SOURce2:CORRection:LOSS[:OUTPut][:MAGNitude] <numeric_value>			
Value range:	-40.0 ... +90.0 dB			Default: 0.0 dB
State: IDLE	Option: none	with Query:	Note: Positive values refer to an attenuation, (N2a)	

2.2. Inputs and Outputs Used

Syntax:	ROUTe:IOConnector <value>			
Value range:	I1O1 |	Input: RF In Out;	Output: RF In Out	Default: I1O1
	I1O2 |	Input: RF In Out;	Output: RF In 2	
	I2O1 |	Input: RF In 2;	Output: RF In Out	
	I2O2	Input: RF In 2;	Output: RF In 2	
State: IDLE	Option: none	With Query	Note: (N2b)	

2.3. Reference Frequency

Syntax:	CONFigure:FREQuency:REFerence <value>		
Value range:	I10M |	Internal, 10 MHz	Default: I10M
	O10M	External, 10 MHz	
State: IDLE	Option: B3	With Query	

2.4. Signalling and RF Parameters

2.4.1. Signalling Parameters for Mobile Station

International Mobile Subscriber Identity (IMSI)

Syntax:	SENSe:SIGNalling:IDENtity:IMSI?		
Return:	<Value> (max. 15 digits)		
State MSYN and MCE	Option: none	only Query	Note: (N2c)

International Mobile Equipment Identity (IMEI)

Syntax:	SENSe:SIGNalling:IDENtity:IMEI?		
Return:	<Value> (max. 15 digits)		
State: MSYN and MCE	Option: none	Only Query	Note: (N2c)

Receiving level at the Mobile Station (RXLEV)

Syntax:	SENSe:SIGNalling:RXLev?		
Return:	0 ... 63 (Full value)		
State: MCE	Option: none	Only Query	Note: (N2c)

Receiving quality at the Mobile Station (RXQUAL)

Syntax:	SENSe:SIGNalling:RXQual?		
Return:	0 ... 7 (Full value)		
State: MCE	Option: none	Only Query	Note: (N2c)

Number selected

Syntax:	SENSe:SIGNalling:DNUMber?		
Return:	<Value> (max. 20 digits)		
State: MCE	Option: none	Only Query	Note: (N2c)

Power Class

Syntax:	SENSe:SIGNalling:POWer:CLASs?		
Return:	GSM: 1 ... 5 DCS1800: 1 ... 2		
State: MSYN and MCE	Option: none	Only Query	Note: (N2c)

Mobile power signalled

This is the value the mobile signals as its own transmitter level. The actual level (peak value) is obtained using SENSe:POWer:MS?.

Syntax:	SENSe:SIGNalling:POWer:LEVel?		
Return	GSM: 13.0 ... 43.0 (Unit: dBm) DCS1800: 4.0 ... 30.0 (Unit: dBm)		
State: MCE	Option: none	Only Query	Note: (N2c)

Measured power of the mobile (peak value)

The transmitter power of the mobile is measured there. The rated value is indicated by SENSe:SIGNalling:POWer:LEVel?.

Syntax:	SENSe:POWer:MS?		
Return:	RF In Out:	(0.0 + ext. att.) ... (+50.0 + ext. att.)	(Unit: dBm)
	RF In 2:	(-60.0 + ext. att.) ... (+13.0 + ext. att.)	(Unit: dBm)
State: MCE, BAN	Option: none	only Query	Note: (N2c)

2.4.2. Signalling Parameters for CMD

Mobile Country Code

Syntax:	CONFigure:SIGNalling:IDENtity:MCC <numeric_value>		
Value range:	0 ... 999		Default: 1
State: IDLE	Option: none	with Query	

Mobile Network Code

Syntax:	CONFigure:SIGNalling:IDENtity:MNC <numeric_value>		
Value range:	0 ... 99		Default: 1
State: IDLE	Option: none	with Query	

Network Colour Code

Syntax:	CONFigure:SIGNalling:IDENtity:NCC <numeric_value>		
Value range:	0 ... 7		Default: 0
State: IDLE	Option: none	with Query	

Location Area Code

Syntax:	CONFigure:SIGNalling:IDENtity:LAC <numeric_value>		
Value range:	0 ... 65535		Default: 1
State: IDLE	Option: none	with Query	

Channel number (ARFCN)

Syntax:	CCCH: CONFigure:CHANnel:CCCH:ARFCn <numeric_value> TCH: CONFigure:CHANnel[:TCH]:ARFCn <numeric_value>		
Value range:	GSM: 1 ... 124 DCS1800: 512 ... 885	Default: GSM:	CCCH 65 TCH 62
		DCS1800:	CCCH 735 TCH 740
State: IDLE	Option: none	with Query	

Timeslot of TCH

Syntax:	CONFigure:CHANnel[:TCH]:SLOT <numeric_value>		
Value range:	0 ... 7		Default: 0
State: IDLE	Option: none	with Query	

Transmitter power of the TCH in the used timeslot

Syntax:	CONFigure:CHANnel[:TCH][:POWer][:USED] <numeric_value>				
Value range:	(N2d)				Default: -90.0 dBm -85.0 dBm
State:	Set: IDLE Query: ALL	Option: none	with Query		

Transmitter power of the TCH in the unused timeslots

Syntax:	CONFigure:CHANnel[:TCH][:POWer]:UNUSed <numeric_value>			
Value range:	-20.0 ... +20.0 dB			Default: -20.0 dB
State: IDLE	Option: none	with Query	Note: (N2e)	

2.5. Burst Analysis

Channel number (ARFCN)

Syntax:	CONFigure:CHANnel:BANalysis:ARFCn <num_val>				
Value range:	GSM: DCS1800:	1 ... 124 512 ... 885		Default:	GSM: 65 DCS1800: 700
State: ALL	Option: B4	With Query			

Training Sequence Codes

Syntax:	CONFigure:CHANnel:BANalysis:TSC <num_val>			
Value range:	0 ... 7			Default: 0
State: ALL	Option: B4	With Query		

Expected power (of mobile station)

Syntax:	CONFigure:BANalysis:POWer:EXPected <num_val>			
Value range:	-60.0 ... +47.0 dBm			Default: + 47.0 dBm
State: ALL	Option: B4	With Query	Note: (N2d)	

2.6. Network and Test Mode

Network

Syntax:	CONFigure:NETWork[:TYPE] <value>			
Value range:	GSM | Dcs1800			Default: GSM
State: IDLE	Option: none	with Query		

Test mode

Syntax:	PROCedure:SELect[:TEST] <value>				
Value range:	NONE |	No test mode (switch-on state)			Default: NONE
	BANalysis |	Burst analysis			
	MANual |	MS test			
	RFGenerator	RF generator			
State: (NONE): ALL		Option: none	With Query		
(BANalysis): IDLE, RFG		B4			
(MANual): IDLE		none			
(RFGenerator): IDLE, BAN		none			

Notes:

(N2a)
-) The transmitter power is adapted, if necessary (see also N2d).
-) The input may be overloaded if an external amplifier is connected.

(N2b)
-) The level is automatically adapted (see N2d).
-) Only one input and output may be active at a time, i.e. the one not selected becomes inactive.
Example:
If I1O1 is selected, RF In Out is selected as input and output, RF In 2 and RF Out 2 are not available then.

(N2c)
RXLEV, RXQUAL and POWER LEVEL are automatically scanned and updated during signalling at regular intervals.
The measurement for SENSe:POWer:MS? is also performed automatically as soon as the call has been set up.

(N2d)
-) The value applies irrespective of the output and is automatically adapted to the output on transition to the MIDL state, which may cause the value range to be shifted.
-) The value applies to the currently set timeslot of the TCH.
-) For the value range, compare Manual Operation, Section 2.

(N2e)
The level for the unused timeslots is to be indicated relative to the level in the used timeslot.
However, it cannot exceed the absolute limit values (see (N2d).

3. Call Setup and Release

Call setup from the CMD to the mobile (Call)

Syntax:	PROCedure:CALL:TOMS		
State: MSYN	Option: none	no Query	

Call release from the CMD to the mobile (Release)

Syntax:	PROCedure:RELease:TOMS		
State: MCE	Option: none	no Query	

Change of channel for TCH

Syntax:	PROCedure:SET:ARFCn <numeric_value>		
Value range:	1 ... 124		
State: MCE	Option: none	with Query	Note: No default value

Change of timeslot for TCH

Syntax:	PROCedure:SET:SLOT <numeric_value>		
Value range:	0 ... 7		
State: MCE	Option: none	with Query	Note: No default value

Power change (Mobile Station, only used timeslot)

Syntax:	PROCedure:SET:POWer:MS <numeric_value>		
Value range:	0 ... 15 | 13.0 ... 43.0 dBm		Power Control Level Absolute level
State: MCE	Option: none	With Query	Note: No default value; return always as Power Control Level

Power change (CMD) in the used timeslot

Syntax:	PROCedure:SET:POWer:CMD[:USED] <numeric_value>		
Value range:	(N2d)		
State: MCE	Option: none	with Query	Note: No default value

Power change (CMD) in the unused timeslots

Syntax:	PROCedure:SET:POWer:CMD:UNUSed <numeric_value>		
Value range:	-20.0 ... +20.0 dB		
State: MCE	Option: none	with Query	Note: no default value, (N2e)

4. RF Generator

4.1. Configuration of a Generator Parameter Set

CONFigure:RFGen:SELect permits to select a parameter set that is to be affected by the modifications by means of CONFigure:RFGen:.... . These modifications are maintained even if a different parameter set is selected.

Selection of generator configuration

Syntax:	CONFigure:RFGen:SELect			
Value range:	SETting1 | SETting2 | SETting3 | SETting4 | SETting5 | SETting6 | SETting7			Default: SET1
State: ALL	Option: none	With Query	Note: (N4)	

Frequency

Syntax:	CONFigure:RFGen:FREQuency[:CW|:FIXed]			
Value range:	GSM: 800.0 ... 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 ... 1897.6 MHz (in steps of 0.2 MHz)			Default: GSM: 900.0 MHz DCS1800: 1750.0 MHz
State: ALL	Option: none	with Query	Note: The entered value is adapted to the specified step size when the parameter set is set. (N4)	

Frequency offset

Syntax:	CONFigure:RFGen:FREQuency:OFFSet			
Value range	-100.009 ... 100.009 kHz (in steps of approx. 33.061 Hz)			Default: 0.0 Hz
State: ALL	Option: none	with Query	Note: The entered value is adapted to the specified step size when the parameter set is set, (N4)	

Type of modulation

Syntax:	CONFigure:RFGen:DM:FORMat			
Value range:	PRS | Pseudo random sequence NONE No modulation			Default: NONE
State: ALL	Option: none	with Query	Note: (N4)	

Ramping Mode

Syntax:	CONFigure:RFGen:RAMPing:STATe			
Value range:	ON | Signal with power ramping OFF Continuous signal			Default: OFF
State: ALL	Option: none	with Query	Note: (N4)	

Output level

Syntax:	CONFigure:RFGen:POWer			
Value range:	(-120.0 - ext. att.) ... (+13.0 - ext. att.) dBm			Default: -80.0 dBm
State: ALL	Option: none	with Query	Note: Level is automatically adapted to the output and the output connection when the parameter set is selected, (N4)	

4.2. Setting of the Current Generator Parameter Set

Setting a generator configuration

Uses the values of the selected configuration and sets the RF generator accordingly. These values can be varied using the following commands. The modifications are lost by a further selection of SOURce:RFGen:SELect.

Syntax:	SOURce:RFGen:SELect			
Value range:	SETting1 | SETting2 | SETting3 | SETting4 | SETting5 | SETting6 | SETting7 | NONE (only with query if the selected configuration has been varied))			Default: SET1
State: RFG	Option: none	with Query	Note: Power level is automatically adapted to the output and the output connection, (N4)	

Frequency

Syntax:	SOURce:RFGen:FREQuency[:CW|:FIXed]			
Value range:	GSM: 800.0 ... 1000.0 MHz (in steps of 0.2 MHz) DCS1800: 1697.6 ... 1897.6 MHz (in steps of 0.2 MHz)			Default: GSM: 900.0 MHz DCS1800: 1750.0 MHz
State: RFG	Option: none	with Query	Note: The entered value is adapted to the indicated step size, (N4)	

Frequency offset

Syntax:	SOURce:RFGen:FREQuency:OFFSet			
Value range:	-100.009 ... 100.009 kHz (in steps of approx. 33.061 Hz)			Default: 0.0 Hz
State: RFG	Option: none	with Query	Note: The entered value is adapted to the indicated step size, (N4)	

Type of modulation

Syntax:	SOURce:RFGen:DM:FORMat			
Value range:	PRS | Pseudo random sequence NONE No modulation			Default: NONE
State: RFG	Option: none	with Query	Note: (N4)	

Ramping Mode

Syntax:	SOURce:RFGen:RAMPing:STATe			
Value range:	ON | Signal with power ramping OFF Continuous signal			Default: OFF
State: RFG	Option: none	with Query	Note: (N4)	

Output level

Syntax:	SOURce:RFGen:POWer			
Value range:	(-120.0 - ext. att.) ... (+13.0 - ext. att.) dBm			Default: -80.0 dBm
State: RFG	Option: none	with Query	Note: Level is automatically adapted to the output and the output connection when the parameter set is selected, (N4)	

Notes:

(N4)
CONFigure:RFGen:SELect is used to select a generator setting in which the values can be configured (with CONFigure:RFGen:...). With SOURce:RFGen:SELect the values of the selected setting are loaded (and adapted to the output or output connection, if necessary). S OURce:RFGen:... permits to modify the values of the selected generator setting (they are lost if a different setting is selected).

5. AF Generator Setting

Frequency

Syntax:	CONFigure:AFGen:FREQuency[:CW|:FIXed]			
Value range:	20.0 ... 10000.0 Hz			Default: 1000.0 Hz
State: ALL	Option: B4 and B41	with Query		

Level

Syntax:	CONFigure:AFGen:VOLTage			
Value range:	10.0 µV ... 5.0 V	(in steps of 10 µV)		Default: 1.0 V
State: ALL	Option: B4 and B41	with Query		

Switching the generator on and off

Syntax:	SOURce:AFGen:STATe			
Value range:	ON | switch on generator OFF switch off generator			Default: OFF
State: ALL except MIDL and MSYN	Option: B4 and B41	with Query	Note: The generator is automatically switched off in the case of burst and BER measurements	

6. AF Setting

Distortion frequency

Syntax:	CONFigure:AFMeas:FREQuency:DISTortion		
Value range:	50.0 ... 5000.0 Hz		Default: 1000.0 Hz
State: ALL	Option: B4 and B41	with Query	

Lower limit frequency (for distortion and voltmeter)

Syntax:	CONFigure:AFMeas:FREQuency:MINimum		
Value range:	10 ... 1000 Hz		Default: 100 Hz
State: ALL	Option: B4 and B41	with Query	Note: This setting affects the duration of measurement.

7. Measurement, Analysis and Result Query

7.1. AF Measurement

Display format of AF counter

Syntax:	CONFigure:AFMeas:COUNter:FORMat			
Value range:	LT10khz | GT10khz			Default: GT10khz
State: ALL	Option: B4 and B41	with Query		

Display format of voltmeter

Syntax:	CONFigure:AFMeas:VOLTage:FORMat			
Value range:	RMS | SQRTrms			Default: RMS
State: ALL	Option: B4 and B41	with Query		

AF counter

Syntax: Execute new measurement and signal result	READ[:SCALar]:AFMeas:COUNter?		
Only read measurement result	FETCh[:SCALar]:AFMeas:COUNter?		
Return:	<Value> (Unit: Hz)		
State: ALL except MIDL and MSYN	Option: B4 and B41	only Query	Note: No default value

AF voltage

Syntax: Execute new measurement and signal result	READ[:SCALar]:AFMeas:VOLTage?		
Only read measurement result	FETCh[:SCALar]:AFMeas:VOLTage?		
Return:	<Value> (Unit: V)		
State: ALL except MIDL and MSYN	Option: B4 and B41	only Query	Note: No default value

Distortion

Syntax: Execute new measurement and signal result	READ[:SCALar]:AFMeas:DISTortion?		
Only read measurement result	FETCh[:SCALar]:AFMeas:DISTortion?		
Return:	<Value> (Unit: %)		
State: ALL except IDL and MSYN	Option: B4 and B41	only Query	Note: No default value

7.2. BER

7.2.1. Selection of the BER Measurement Configuration (Parameter Set)

Syntax:	CONFigure:BER:SELect <value>			
Value range:	BER1 | BER2 | BER3 | BER4 | BER5 | BER6 | BER7			Default: BER1
State: ALL	Option: B4	with Query	Note: (N6a)	

7.2.2. Measurement Tolerances for the BER Measurement Configuration Selected

Maximal values for class-Ib events

Syntax:	CALCulate:LIMit:BER:CLIB:MEVents <numeric_value>		
Value range:	0 ... 100000		
State: ALL	Option: B4	with Query	Note: No default value, (N6c)

Maximal values for class-II events

Syntax:	CALCulate:LIMit:BER:CLII:MEVents <numeric_value>		
Value range:	0 ... 100000		
State: ALL	Option: B4	with Query	Note: No default value, (N6c)

Maximal values for erased frames

Syntax:	CALCulate:LIMit:BER:EFRames:MEVents <numeric_value>		
Value range:	0 ... 10000		
State: ALL	Option: B4	with Query	Note: No default value, (N6c)

7.2.3. Measurement Parameters for the BER Measurement Configuration Selected

Level for TCH in the used timeslot

Syntax:	CONFigure:BER:POWer[:USED] <numeric_value>		
Value range:	(N2d)		
State: ALL	Option: B4	with Query	Note: No default value, (N6a)

Level for TCH in the unused timeslots

Syntax:	CONFigure:BER:POWer:UNUSed <numeric_value>		
Value range:	-20 ... +20 dB		
State: ALL	Option: B4	with Query	Note: No default value, (N2e), (N6a)

Number of frames to be sent

Syntax:	CONFigure:BER:FRAMestosend <numeric_value>		
Value range:	1 ... 10000		
State: ALL	Option: B4	with Query	Note: No default value

Maximal number of the samples to be sent and test time

The maximum number of samples sent in the test is derived from the value for "Frames to send". These values are only reached in the test if the errors occurring do not exceed the tolerance limits or ASAMples is selected as an abort condition (CONFigure:BER:SCONdition).

Syntax:	CONFigure:BER:CLIB:MSAMples? CONFigure:BER:CLII:MSAMples? CONFigure:BER:EFRames:MSAMples? CONFigure:BER:TEST:TIME?		
Return:	78 ... 780000 (Class IB) 132 ... 1320000 (CLass II) 1 ... 10000 (Erased Frames) 0.02 ... 200 (Test time, unit: sec)		
State: ALL	Option: B4	only Query	Note: The values have been derived from "Frames to send" and thus cannot be set

Abort condition for BER measurement

Syntax:	CONFigure:BER:SCONdition <value>		
Value range:	ASAMples | Abort when all samples have been transmitted FLIMit | Abort on first exceeding of a limit ALIMits Abort when all limits have been reached		
State: ALL	Option: B4	with Query	Note: No default value

7.2.4. Measurement

Measured values of class Ib

Syntax: Execute new measurement and signal result	READ[:SCALar]:BER:CLIB[:BER]? READ[:SCALar]:BER:CLIB:EVENts? READ[:SCALar]:BER:CLIB:RBER?		
Only read measured value	FETCh[:SCALar]:BER:CLIB[:BER]? FETCh[:SCALar]:BER:CLIB:EVENts? FETCh[:SCALar]:BER:CLIB:RBER?		
Return:	BER and RBER: 0 ... 100 (Unit: percent) Events: 0 ... 100000		
State: MCE	Option: B4	Only Query	Note: No default value, (N6b)

Measured values of class II

Syntax: Execute new measurement and signal result	READ[:SCALar]:BER:CLII[:BER]? READ[:SCALar]:BER:CLII:EVENts? READ[:SCALar]:BER:CLII:RBER?		
Only read measured value	FETCh[:SCALar]:BER:CLII[:BER]? FETCh[:SCALar]:BER:CLII:EVENts? FETCh[:SCALar]:BER:CLII:RBER?		
Return:	BER and RBER: 0 ... 100 (Unit: percent) Events: 0 ... 100000		
State: MCE	Option: B4	Only Query	Note: No default value, (N6b)

Measured values of the erased frames

Syntax: Execute new measurement and signal result Only read measured value	READ[:SCALar]:BER:EFRames[:FER]? READ[:SCALar]:BER:EFRames:EVENts? FETCh[:SCALar]:BER:EFRames[:FER]? FETCh[:SCALar]:BER:EFRames:EVENts?		
Return:	FER: 0 ... 100 (Unit: percent) Events: 0 ... 10000		
State: MCE	Option: B4	Only Query	Note: No default values, (N6b)

Total result of a BER measurement

Syntax: Execute new measurement and signal result Only read result	READ[:SCALar]:BER:TRESult? FETCh[:SCALar]:BER:TRESult?		
Return:	PASS | Results valid, all configured frames sent; all tolerances observed FAIL | Results valid, but not all frames sent and/or tolerances observed INV | Measurement results are invalid TLOW | BS signal level too low, results are not valid IMP No measurement possible, results are not valid		
State: MCE	Option: B4	Only Query	Note: No default value; (N6b)

7.3. Power

7.3.1. Tolerance Limits

Resetting to default values

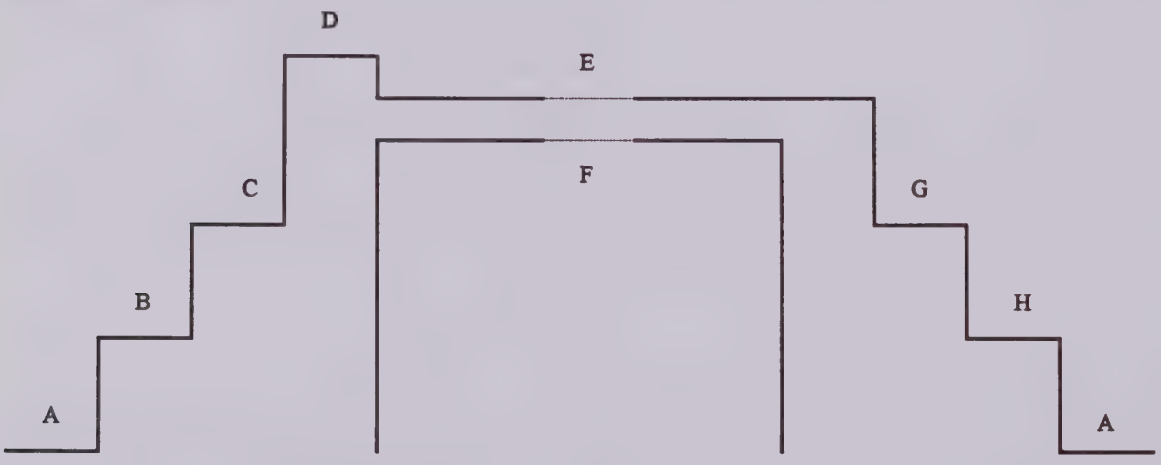
Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:CLEar		
State: ALL	Option: B4	No Query	Note: Sets the GSM/ DCS1800 tolerances

Tolerance limits for average power in the power time template

Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:TOLerance1[:DATA] <numeric_value> CALCulate:LIMit:POWer[:TEMPlate]:TOLerance2[:DATA] <numeric_value> CALCulate:LIMit:POWer[:TEMPlate]:TOLerance3[:DATA] <numeric_value>			
Value range:			Deviation from expected value	Default:
	GSM:			
	CALC:LIM:POW:TOL1	0.0 ... +6.0 dB	with maximum power control level	+2.0 dBm
	CALC:LIM:POW:TOL2	0.0 ... +6.0 dB	with all other power control levels	+3.0 dBm
	CALC:LIM:POW:TOL3	no effect with GSM		+3.0 dBm
	DCS1800:			
	CALC:LIM:POW:TOL1	0.0 ... +6.0 dB	with maximum power control level	+2.0 dBm
	CALC:LIM:POW:TOL2	0.0 ... +6.0 dB	up to power control level 8	+3.0 dBm
	CALC:LIM:POW:TOL3	0.0 ... +6.0 dB	after power control level 9	+4.0 dBm
State: ALL	Option: B4	with Query	Note: The deviations always apply symmetrically about the expected value	

Tolerance limits for power time template

The level designations in the power time template of command CALCulate:LIMit:POWer[:TEMPlate][:DATA] can be taken from the following illustration:



Syntax:	CALCulate:LIMit:POWer[:TEMPlate][:DATA] <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>, <numeric_value>		
Value range:	-100.0 ... 0.0 dBm	Absolute level at A	Default: GSM: -36.0 dBm DCS1800: -47.0 dBm
	-100.0 ... 0.0 dB	Relative level at A	-70.0 dB
	-100.0 ... 0.0 dB	Relative level at B	-30.0 dB
	-100.0 ... 0.0 dB	Relative level at C	-6.0 dB
	0.0 ... +20.0 dB	Relative level at D	+4.0 dB
	0.0 ... +5.0 dB	Relative level at E	+1.0 dB
	-5.0 ... 0.0 dB	Relative level at F	-1.0 dB
	-100.0 ... 0.0 dB	Relative level at G	-6.0 dB
	-100.0 ... 0.0 dB	Relative level at H	-30.0 dB
State: ALL	Option: B4	with Query	

Query for the observance of the tolerance limits for average power

Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:TOLerance:MATChing?		
Return:	(MATC | NMAT | INV)		
State: MCE	Option: B4	only Query	Note: Supplies the result for the last measurement, (N6d), (N6f)

Query for the observance of the tolerance limits of the power time template

Syntax:	CALCulate:LIMit:POWer[:TEMPlate]:MATChing?		
Return:	(MATC | NMAT | INV)		
State: MCE, BAN	Option: B4	Only Query	Note: Supplies the result for the last measurement, (N6d), N6f)

7.3.2. Power Measurement

Average power of the burst

Syntax: Execute new measurement and signal result Only read measured value	READ[:SCALar]:BURSt:POWer:AVERage? FETCh[:SCALar]:BURSt:POWer:AVERage?		
Return:	<Value>	(Unit: dBm)	
State: MCE, BAN	Option: B4	Only Query	Note: No default value, (N6d)

Power values of the entire burst

Syntax: Execute new measurement and signal result Only read measured value	READ:ARRay:BURSt:POWer? FETCh:ARRay:BURSt:POWer?		
Return:	<Value> {, <Value>}	(Unit: dB)	
State: MCE, BAN	Option: B4	Only Query	Note: No default values;(N6d), (N6e)

7.4. Phase and Frequency Errors

7.4.1. Tolerance Limits

`Resetting to default values`

Syntax:	CALCulate:LIMit:PHFR:CLEar		
State: ALL	Option: B4	No Query	Note: Sets the GSM or DCS1800 tolerance limits

`Tolerance limits for phase and frequency error`

Syntax:	CALCulate:LIMit:PHFR:TOLerance[:DATA] <numeric_value>, <numeric_value>, <numeric_value>		
Value range:	0.0 ... 100.0 deg 0.0 ... 25.0 deg 0.0 ... 200.0 Hz	(Peak phase error) (RMS phase error) (Frequency error)	Default:20.0 deg 5.0 deg 90.0 Hz
State: ALL	Option: B4	with Query	

`Query for the observance of the tolerance limits`

Syntax:	CALCulate:LIMit:PHFR:TOLerance:MATChing?		
Return:	(MATC | NMAT | INV), MATC | NMAT | INV), (MATC | NMAT | INV)	(Peak phase error) (RMS phase error (Frequency error)	
State: MCE, BAN	Option: B4	only Query	Note: Supplies the result of the last measurement (N6d), (N6f)

7.4.2. Phase Error Measurement

`Total phase error of a burst`

Syntax: Execute new measurement and signal result Only read measured value	RMS: READ[:SCALar]:BURSt:PHASe:ERRor:RMS? Peak: READ[:SCALar]:BURSt:PHASe:ERRor:PEAK? RMS: FETCh[:SCALar]:BURSt:PHASe:ERRor:RMS? Peak: FETCh[:SCALar]:BURSt:PHASe:ERRor:PEAK?		
Return:	<Value>	(Unit: degrees)	
State: MCE, BAN	Option: B4	Only Query	Note: No default values, (N6d)

`Phase error values of the entire burst`

Syntax: Execute new measurement and signal result Only read measured value	READ:ARRay:BURSt:PHASe:ERRor? FETCh:ARRay:BURSt:PHASe:ERRor?		
Return:	<Value> {, <Value>}	(Unit: degrees)	
State: MCE, BAN	Option: B4	Only Query	Note: No default values, (N6d), (N6e)

7.4.3. Frequency Error Measurement

`Total frequency error of a burst`

Syntax:	
Execute new measurement and signal result	READ[:SCALar]:BURSt:FREQuency:ERRor?
Only read measured value	FETCh[:SCALar]:BURSt:FREQuency:ERRor?

Return:	<Value>	(Unit: Hz)	
State: MCE, BAN	Option: B4	Only Query	Note: No default value, (N6d)

7.5. Other Measurements

Current measurement

Syntax:		
Execute measurement and signal result	READ[:SCALar]:CURRent[:DC]?	(Average)
	READ[:SCALar]:CURRent[:DC]:MAXimum?	(Maximum)
	READ[:SCALar]:CURRent[:DC]:MINimum?	(Minimum)
Only read measured value	FETCh[:SCALar]:CURRent[:DC]?	(Average)
	FETCh[:SCALar]:CURRent[:DC]:MAXimum?	(Maximum)
	FETCh[:SCALar]:CURRent[:DC]:MINimum?	(Minimum)

Return:	<Value>	(Unit: A)	
State ALL	Option: none	only Query	Note: No default values

Voltage measurement

Syntax:	
Execute new measurement and signal result	READ[:SCALar]:VOLTage[:DC]?
Only read measured value	FETCh[:SCALar]:VOLTage[:DC]?

Return:	<Value>	(Unit: V)	
State: ALL	Option: none	only Query	Note: No default value

Notes:

(N6a)
CONFigure:BER:SELect permits to select a BER measurement; the settings can be changed and a measurement be executed for the selected measurement.
If a new BER measurement is selected, the measured values of the previous measurement are maintained (and can still be fetched using FETCh). However, the total result (FETCh:BER:TRESult) is set to INValid.
When the new measurement is started, the measured values are updated (which means that the results of the previous measurement are lost).

(N6b)
A new measurement is started and the desired value returned by means of any READ command. Then all results of this measurement can be read one after the other by means of FETCh queries without a new measurement being performed (FETCh[:SCALar]:BER:TRESult? provides a statement on the validity of the measured values).

(N6c)
The tolerances are only taken into account if the abort condition for the BER measurement is set to FLIMit or ALIMits (CONFigure:BER:SCONdition).

(N6d)
When a READ command is selected, all scalar measurement results (average power, RMS and peak phase error and frequency error) are calculated and the desired value is returned; the remaining measurement results can be fetched using FETCh or CALCulate. The field values cannot be obtained.
However, if the measurement is made via READ:ARRay, all scalar values are provided in addition to the selected field values. The measurement of the field values of the power (READ:ARRay:BURSt:POWer?) and of the phase error (READ:ARRay:BURSt:PHASe:ERRor?) exclude one another, i.e. it is not possible to fetch the phase error using FETCh:ARRay:BURSt:PHASe:ERRor? after READ:ARRay:BURSt:POWer?.

(N6e)
The values are calculated in ¼-bit steps and are supplied in the range from bit index -10.0 to bit index +157.0 (power) or +0.5 to +147.5 (phase error) (referred to the useful part of the burst); this results in 669 power values and 588 phase error values.

(N6f)
The results in the tolerance query have the following meaning:

MATC:	The measurement result observes the limits configured
NMAT:	The measurement result does not observe the limits configured
INV:	There is no measurement result

8. Miscellaneous

8.1. Internal Instrument State

Current status of the instrument

Syntax:	STATus:DEVice?		
Return:	IDLE |	Idle (Initial state)	Default: IDLE
	BAN |	Burst analysis	
	MIDL |	MS Test: Idle	
	MCE |	MS Test: Call Established	
	MSYN	MS Test: Synched	
	RFG	RF generator	
State: ALL	Option: none	Only Quer.	

8.2. Signalling Asynchronous Events

The CMD event register is used to signal events the CMD executes without having explicitly received a request via remote control. The controller can query the events via the remote control.

The CMD enters the following events by setting the respective bit in the CMD event register:

Event	CMD Event Register
Call From Mobile	Bit 0
Release From Mobile	Bit 1
Synchronisation Lost	Bit 2
Location Update	Bit 3

Setting a bit in the CMD event register leads to the setting of a bit in the operation status register and then in the status byte and thus - with the IEC bus - to a service request (provided that the respective enable registers permit the events).

A detailed explanation of the connections in the hierarchy of the SCPI registers can be found in SCPI manual 1993.0, volume 1 on page 9-4.

CMD Event Register

Syntax:	STATus:OPERation:CMD[:EVENt]?		
Return:	0 ... 15		Default: 0
State: ALL	Option: none	Only Query	

CMD Operation Condition Register

Syntax:	STATus:OPERation:CMD:CONDition?		
Return:	0 ... 32767		Default: 0
State: ALL	Option: none	Only Query	

CMD Event Register Enable

Syntax:	STATus:OPERation:CMD:ENABle <numeric_value>		
Value range:	0 ... 32767		Default: 32767
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible

8.3. Query of Options

Syntax:	SYSTem:OPTions?		
Return:	List of all existing options (as Bx, with x as number of the option), separated by means of commas; options not existing are not indicated. Example: Options B1,B4,B41,B6,B61 and B9 exist, then the output is: B1,,B4,B41,,,B6,B61,,,,,,,B9		
State: ALL	Option: none	Only Query	Note: No default value

8.4. Remote Control

`Screen display of the remote-control commands and responses`

Syntax:	DISPlay:ENABle			
Value range:	ON | OFF	Remote-control commands and responses appear on the screen No screen outputs		Default: ON
State: ALL	Option: none	With Query	Note:	

`IEC-bus address`

Syntax:	SYSTem:COMMunicate:GPIB[:SELF]:ADDRess <numeric_value>		
Value range:	0 ... 30		Default: 1
State ALL	Option: none	with Query	

9. Specified Commands

9.1. Mandatory Commands

Clear Status

Syntax:	*CLS		
State: ALL	Option: none	No Query	

Standard Event Status Enable

Syntax:	*ESE <numeric_value>			
Value range:	0 ... 255			Default: 0
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible	

Standard Event Status Register

Syntax:	*ESR?		
Return:	0 ... 255		
State: ALL	Option: none	Only Query	

Identification Query

Syntax:	*IDN?		
Return:	Rohde&Schwarz,CMD,0,x.xx yy.yy.yy	(x.xx is SW version, e.g. V 1.00 yy.yy.yy is the date, e.g. 10/18/93)	
State: ALL	Option: none	Only Query	

Individual Status Query

Syntax:	*IST?		
Return:	0 | 1		
State: ALL	Option: none	Only Query	

Operation Complete

Syntax:	*OPC		
Return:	1	(return only in the case of query)	
State: ALL	Option: none	with Query	Note: Also influences the OPC bit in the event status register

Parallel Poll Enable Register Enable

Syntax:	*PRE <numeric_value>			
Value range:	0 ... 255			Default: 0
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible	

Power-on Status Clear

Syntax:	*PSC <numeric_value>		
Value range:	-32767 ... 32767		Default: 1
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible

Reset

Syntax:	*RST		
State: ALL	Option: none	No Query	Note: Causes the instrument to be in the default state (without considering a connection set up)

Service Request Enable

Syntax:	*SRE <numeric_value>		
Value range:	0 ... 255		Default: 0
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible

Status Byte Query

Syntax:	*STB?		
Return:	0 ... 255		
State: ALL	Option: none	Only Query	

Self-Test

Syntax:	*TST?		
Return:	0 ... 255		
State: ALL	Option: none	Only Query	Note: No error in the self-test is indicated by means of value 0

Wait-to-Continue

Syntax:	*WAI		
State: ALL	Option: none	No Query	

9.2. Optional Commands

Query of options

Syntax:	*OPT?		
Return:	Identical with SYSTem:OPTions?		
State: ALL	Option: none	Only Query	Note: No default value, identical with SYSTem:OPTions?

9.3. STATus Subsystem

Operation Event Register

Syntax:	STATus:OPERation[:EVENt]?			
Return:	0 ... 32767			Default: 0
State: ALL	Option: none	Only Query	Note: Bit 8 is used as a summary bit for the CMD event register.	

Operation Condition Register

Syntax:	STATus:OPERation:CONDition?		
Return:	0 ... 32767		Default: 0
State: ALL	Option: none	Only Query	

Operation Event Register Enable

Syntax:	STATus:OPERation:ENABle <numeric_value>			
Value range:	0 ... 32767			Default: 0
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible; Bit 8 is used for the CMD event register.	

Questionable Event Register

Syntax:	STATus:QUEStionable[:EVENt]?		
Return:	0 ... 32767		Default: 0
State: ALL	Option: none	Only Query	

Questionable Condition Register

Syntax:	STATus:QUEStionable:CONDition?		
Return:	0 ... 32767		Default: 0
State: ALL	Option: none	Only Query	

Questionable Event Register Enable

Syntax:	STATus:QUEStionable:ENABle <numeric_value>		
Value range:	0 ... 32767		Default: 0
State: ALL	Option: none	with Query	Note: MAXimum and MINimum impermissible

Resetting the instrument

Syntax:	STATus:PRESet		
State: ALL	Option: none	No Query	

Status Queue

Syntax:	STATus:QUEue[:NEXT]?		
Return:	cf. SCPI, Section 20.8 (p. 20-6)		Default: 0, "no error"
State: ALL	Option: none	Only Query	

9.4. SYSTem Subsystem

Next message from error queue

Syntax:	SYSTem:ERRor?		
Return:	cf. SCPI, Section 21.7 (p. 21-10)		Default: 0, "no error"
State: ALL	Option: none	Only Query	

SCPI Version

Syntax:	SYSTem:VERSion?		
Return:	cf. SCPI, Section 21.18 (p. 21-28)		Default: 1993.0
State: ALL	Option: none	Only Query	

10. Summary of All Commands

The software version indicates the version number after which the corresponding command is implemented in the CMD software.

Command		Software version
*CLS	No Query	1.50
*ESE		1.50
*ESR?	Only Query	1.50
*IDN?	Only Query	1.50
*IST?	Only Query	1.50
*OPC		1.50
*OPT?	Only Query	1.60
*PRE		1.50
*PSC		1.50
*RST	No Query	1.50
*SRE		1.50
*STB?	Only Query	1.50
*TST?	Only Query	1.50
*WAI	No Query	1.50
CALCulate:LIMit:BER:CLIB:MEVents		1.50
CALCulate:LIMit:BER:CLII:MEVents		1.50
CALCulate:LIMit:BER:EFRames:MEVents		1.50
CALCulate:LIMit:PHFR:CLEar	No Query	1.50
CALCulate:LIMit:PHFR:TOLerance[:DATA]		1.50
CALCulate:LIMit:PHFR:TOLerance:MATChing?	Only Query	1.50
CALCulate:LIMit:POWer[:TEMPlate]:CLEar	No Query	1.50
CALCulate:LIMit:POWer[:TEMPlate][:DATA]		1.50
CALCulate:LIMit:POWer[:TEMPlate]:MATChing?	Only Query	1.50
CALCulate:LIMit:POWer[:TEMPlate]:TOLerance[:DATA]		1.50
CALCulate:LIMit:POWer[:TEMPlate]:TOLerance:MATChing?	Only Query	1.50
CONFigure:AFGen:FREQuency[:CW|:FIXed]		1.60
CONFigure:AFGen:VOLTage		1.60
CONFigure:AFMeas:COUNter:FORMat		1.60
CONFigure:AFMeas:FREQuency:DISTortion		1.60
CONFigure:AFMeas:FREQuency:MINimum		1.60
CONFigure:AFMeas:VOLTage:FORMat		1.60
CONFigure:BER:CLIB:MSAMples?	Only Query	1.50
CONFigure:BER:CLII:MSAMples?	Only Query	1.50
CONFigure:BER:EFRames:MSAMples?	Only Query	1.50
CONFigure:BER:FRAMestosend		1.50
CONFigure:BER:POWer:UNUSed		1.50
CONFigure:BER:POWer[:USED]		1.50
CONFigure:BER:SCONdition		1.50
CONFigure:BER:SELect		1.50
CONFigure:BER:TEST:TIME?	Only Query	1.50
CONFigure:CHANnel:CCCH:ARFCn		1.50
CONFigure:CHANnel:BANalysis:ARFCn		1.60
CONFigure:CHANnel:BANalysis:TSC		1.60
CONFigure:CHANnel[:TCH]:ARFCn		1.50
CONFigure:CHANnel[:TCH]:SLOT		1.50
CONFigure:CHANnel[:TCH][:POWer]:UNUSed		1.50
CONFigure:CHANnel[:TCH][:POWer][:USED]		1.50
CONFigure:FREQuency:REFerence		1.50
CONFigure:BANalysis:POWer:EXPected		1.60
CONFigure:NETWork[:TYPE]		1.60
CONFigure:RFGen:DM:FORMat		1.60
CONFigure:RFGen:FREQuency[:CW|:FIXed]		1.60

CONFigure:RFGen:FREQuency:OFFSet 1.60
CONFigure:RFGen:POWer 1.60
CONFigure:RFGen:RAMPing:STATe 1.60
CONFigure:RFGen:SELect 1.60
CONFigure:SIGNalling:IDENtity:LAC 1.50
CONFigure:SIGNalling:IDENtity:MCC 1.50
CONFigure:SIGNalling:IDENtity:MNC 1.50
CONFigure:SIGNalling:IDENtity:NCC 1.50

DISPlay:ENABle 1.60

FETCh:ARRay:BURSt:PHASe:ERRor? ..... Only Query 1.50
FETCh:ARRay:BURSt:POWer? ..... Only Query 1.50
FETCh[:SCALar]:AFMeas:COUNter? ..... Only Query 1.60
FETCh[:SCALar]:AFMeas:DISTortion? ..... Only Query 1.60
FETCh[:SCALar]:AFMeas:VOLTage? ..... Only Query 1.60
FETCh[:SCALar]:BER:CLIB[:BER]? ..... Only Query 1.50
FETCh[:SCALar]:BER:CLIB:EVENts? ..... Only Query 1.50
FETCh[:SCALar]:BER:CLIB:RBER? ..... Only Query 1.50
FETCh[:SCALar]:BER:CLII[:BER]? ..... Only Query 1.50
FETCh[:SCALar]:BER:CLII:EVENts? ..... Only Query 1.50
FETCh[:SCALar]:BER:CLII:RBER? ..... Only Query 1.50
FETCh[:SCALar]:BER:EFRames:EVENts? ..... Only Query 1.50
FETCh[:SCALar]:BER:EFRames[:FER]? ..... Only Query 1.50
FETCh[:SCALar]:BER:TRESult? ..... Only Query 1.50
FETCh[:SCALar]:BURSt:FREQuency:ERRor? ..... Only Query 1.50
FETCh[:SCALar]:BURSt:PHASe:ERRor:PEAK? ..... Only Query 1.50
FETCh[:SCALar]:BURSt:PHASe:ERRor:RMS? ..... Only Query 1.50
FETCh[:SCALar]:BURSt:POWer:AVERage? ..... Only Query 1.50
FETCh[:SCALar]:CURRent[:DC]? ..... Only Query 1.50
FETCh[:SCALar]:CURRent[:DC]:MAXimum? ..... Only Query 1.50
FETCh[:SCALar]:CURRent[:DC]:MINimum? ..... Only Query 1.50
FETCh[:SCALar]:VOLTage[:DC]? ..... Only Query 1.50

PROCedure:CALL:TOMS ..... No Query 1.50
PROCedure:RELease:TOMS ..... No Query 1.50
PROCedure:SELect[:TEST] 1.50
PROCedure:SET:ARFCn 1.50
PROCedure:SET:POWer:CMD:UNUSed 1.50
PROCedure:SET:POWer:CMD[:USED] 1.50
PROCedure:SET:POWer:MS 1.50
PROCedure:SET:SLOT 1.50

READ:ARRay:BURSt:PHASe:ERRor? ..... Only Query 1.50
READ:ARRay:BURSt:POWer? ..... Only Query 1.50
READ[:SCALar]:AFMeas:COUNter? ..... Only Query 1.60
READ[:SCALar]:AFMeas:DISTortion? ..... Only Query 1.60
READ[:SCALar]:AFMeas:VOLTage? ..... Only Query 1.60
READ[:SCALar]:BER:CLIB[:BER]? ..... Only Query 1.50
READ[:SCALar]:BER:CLIB:EVENts? ..... Only Query 1.50
READ[:SCALar]:BER:CLIB:RBER? ..... Only Query 1.50
READ[:SCALar]:BER:CLII[:BER]? ..... Only Query 1.50
READ[:SCALar]:BER:CLII:EVENts? ..... Only Query 1.50
READ[:SCALar]:BER:CLII:RBER? ..... Only Query 1.50
READ[:SCALar]:BER:EFRames:EVENts? ..... Only Query 1.50
READ[:SCALar]:BER:EFRames[:FER]? ..... Only Query 1.50
READ[:SCALar]:BER:TRESult? ..... Only Query 1.50
READ[:SCALar]:BURSt:FREQuency:ERRor? ..... Only Query 1.50
READ[:SCALar]:BURSt:PHASe:ERRor:PEAK? ..... Only Query 1.50
READ[:SCALar]:BURSt:PHASe:ERRor:RMS? ..... Only Query 1.50

READ[:SCALar]:BURSt:POWer:AVERage? ..... Only Query 1.50
READ[:SCALar]:CURRent[:DC]? ..... Only Query 1.50
READ[:SCALar]:CURRent[:DC]:MAXimum? ..... Only Query 1.50
READ[:SCALar]:CURRent[:DC]:MINimum? ..... Only Query 1.50
READ[:SCALar]:VOLTage[:DC]? ..... Only Query 1.50

ROUTe:IOConnector 1.50

SENSe:CORRection:LOSS[:INPut][:MAGNitude] 1.50
SENSe:POWer:MS? ..... Only Query 1.50
SENSe:SIGNalling:DNUMber? ..... Only Query 1.50
SENSe:SIGNalling:IDENtity:IMEI? ..... Only Query 1.50
SENSe:SIGNalling:IDENtity:IMSI? ..... Only Query 1.50
SENSe:SIGNalling:POWer:CLASs? ..... Only Query 1.50
SENSe:SIGNalling:POWer:LEVel? ..... Only Query 1.50
SENSe:SIGNalling:RXLev? ..... Only Query 1.50
SENSe:SIGNalling:RXQual? ..... Only Query 1.50

SOURce:AFGen:STATe 1.60
SOURce:CORRection:LOSS[:OUTPut][:MAGNitude] 1.50
SOURce:RFGen:DM:FORMat 1.60
SOURce:RFGen:FREQuency[:CW|:FIXed] 1.60
SOURce:RFGen:FREQuency:OFFSet 1.60
SOURce:RFGen:POWer 1.60
SOURce:RFGen:RAMPing:STATe 1.60
SOURce:RFGen:SELect 1.60

STATus:DEVice? ..... Only Query 1.50
STATus:OPERation:CMD:CONDition? ..... Only Query 1.50
STATus:OPERation:CMD:ENABle 1.50
STATus:OPERation:CMD[:EVENt]? ..... Only Query 1.50
STATus:OPERation:CONDition? ..... Only Query 1.50
STATus:OPERation:ENABle 1.50
STATus:OPERation[:EVENt]? ..... Only Query 1.50
STATus:PRESet ..... No Query 1.50
STATus:QUEStionable:CONDition? ..... Only Query 1.50
STATus:QUEStionable:ENABle 1.50
STATus:QUEStionable[:EVENt]? ..... Only Query 1.50
STATus:QUEue[:NEXT]? ..... Only Query 1.50

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 1.50
SYSTem:ERRor? ..... Only Query 1.50
SYSTem:OPTions? ..... Only Query 1.50
SYSTem:VERSion? ..... Only Query 1.50

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